THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

[REGISTERED AS A NEWSPAPER.]

VOL. XXXIII. No. 833.] LONDON, APRIL 29, 1879. [31ST YEAR.] Price 6d.

GAS PURIFICATION
BY
OXIDE OF IRON.

COOKE BROS.,
CENTRAL DEPÔTS:
CO. DONEGAL, IRELAND;
LONDON DEPÔT:
BLACKWALL, E.;
OFFICES:
26, 27, & 28, FENCHURCH ST.,
LONDON, E.C.

GENUINE TORBAY PAINT
And SPECIAL GASOMETER PAINT.
SEVERAL PRIZE MEDALS. ESTABLISHED OVER 20 YEARS.
These Paints are now used in over 200 Country Gas-Works, and by all the London Gas Companies, on Gas-holders, Scrubbers, Purifiers, &c. Also used by the Admiralty, War Office, Railway Companies, Founders, &c. They prevent and arrest rust, and protect iron from the action of water, sulphurous and gaseous exhalations; do not crack, blister, or flake off; will cover tar effectually.
The covering powers are considerably greater than those of any other Paint.—*See "Engineer," Nov. 2, 1866.*
Supplied, mixed ready for use, or in paste, as desired.
TORBAY PAINT COMPANY.
PROPRIETORS: STEVENS & CO.,
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WORKS: BRIXHAM, TORBAY.

THOMAS PROUD,
BROOKFIELD GAS APPARATUS WORKS,
103, ICKNIELD STREET EAST, BIRMINGHAM.
CONTRACTOR FOR
LAYING MAINS
FOR
Gas, Water, & Sanitary Purposes,
AND MANUFACTURER OF
WOOD GRIDS
FOR
SCRUBBERS AND PURIFIERS.

COWEN'S PATENT FIRE-CLAY RETORTS.
JOSEPH COWEN and CO.,
BLAYDON BURN, BLAYDON-ON-TYNE,
Were the only parties to whom a PRIZE MEDAL was awarded at the GREAT EXHIBITION of 1851, for "GAS-RETORTS and OTHER OBJECTS in FIRE-CLAY," and they were also awarded at the INTERNATIONAL EXHIBITION of 1862, the PRIZE MEDAL for "GAS-RETORTS, FIRE-BRICKS, &c., for EXCELLENCE of QUALITY."
J. C. and Co. have been for many years the most extensive Manufacturers of Fire-Clay Retorts and Fire-Bricks in the Kingdom. Orders for Fire-Clay Retorts of all shapes and dimensions, and to fit any shaped Mouthpiece, Fire-Bricks, and every other article in Fire-Clay, are promptly executed at their Works as above.
COWEN'S GARESFIELD COALS.
JOS. COWEN & CO. are the only Manufacturers of FIRE-BRICKS and CLAY RETORTS at BLAYDON BURN.

JOHN RUSSELL & CO.,
LIMITED,
Established at the commencement of Gas Lighting,
MANUFACTURERS OF
TUBES AND FITTINGS.
THREE PRIZE MEDALS,
Paris, 1878.
HEAD LONDON OFFICE:
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ALMA TUBE-WORKS, WALSALL;
OLD PATENT TUBE-WORKS, WEDNESBURY.

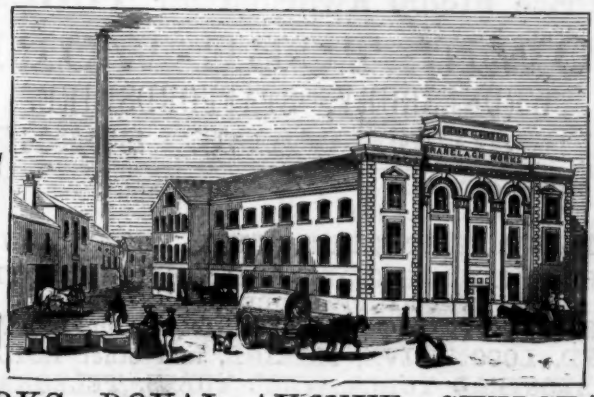
JOHN BENT & SON,
BELL BARN ROAD, BIRMINGHAM,
MANUFACTURERS OF
WET AND DRY GAS-METERS,
LICENSEES AND MANUFACTURERS OF
HUNTS
PATENT COMPENSATING METERS,
STREET-LAMPS, &c., &c.
ESTABLISHED 1830.

THOMAS PIGGOTT & CO.,
SPRING HILL, BIRMINGHAM,
MANUFACTURERS OF
TELESCOPIC & SINGLE GASHOLDERS,
CAST & WROUGHT IRON TANKS FOR DITTO,
And Gas Apparatus of every Description.
Marine, Tubular, Cornish, Plain, Furnace, Saddle, and Range Boilers.
SUGAR, SALTPETRE, AND ALL KINDS OF PANS.
Roofs, Girders, and Bridges, and General Smith's Work.
London Offices: 97, CANNON STREET—
JAMES E. & SAMUEL SPENCER, Agents.

THE
"OTTO" GAS-ENGINE.
See Page 626.
CROSSLEY BROTHERS,
MANCHESTER AND LONDON.

THE
NITSHILL COMPANY'S
DUKE OF HAMILTON'S
LESMAHAGOW
CANNEL COAL.
AGENT:
JAMES M'KELVIE,
HAYMARKET,
EDINBURGH.

CHANGE OF ADDRESS.
GEORGE GLOVER AND CO.,
DRY GAS-METER MANUFACTURERS,
HAVE REMOVED TO MORE EXTENSIVE PREMISES:



RANELAGH WORKS, ROYAL AVENUE, CHELSEA, LONDON, S.W.

SILVER MEDAL, PARIS EXHIBITION, 1867.

LLOYD AND LLOYD,

ALBION TUBE-WORKS, BIRMINGHAM,

AND

COOMBS WOOD TUBE-WORKS, HALESOWEN,

MANUFACTURERS OF

WROUGHT-IRON TUBES AND FITTINGS,

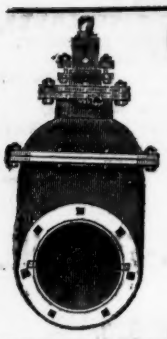
AND

LAP-WELDED IRON AND HOMOGENEOUS METAL BOILER TUBES,

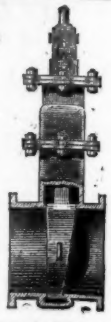
UP TO FOUR FEET IN DIAMETER.

London Offices: No. 4, Cloak Lane, Queen Street, E.C.

Warehouses: London, Liverpool, Manchester, and Lille.



C. & W. WALKERS' DOUBLE-FACED GAS-VALVES.



These solidly constructed double-faced Gas-Valves have taken the place of the old system of the light, single-faced disc, which is too uncertain and unreliable in large bores.

They are guaranteed absolutely gas-tight. They are very massive and rigid, and by improved modes of manufacture they are produced at very little excess in cost over the old light, weak system, which is liable to spring and bend, and become leaky.

The Valve is a rigid wedge of solid cast iron, having two perfectly scraped surfaced facings fitting between the two on the body, which are also surfaced.

A spring in two short halves, and, therefore, not liable to break, is used only for scraping the front facing clean.

The front facing is vertical; the back facing forms the wedge.

At a slight additional expense both flanges are faced to bolt to main-pipes.

MIDLAND IRON-WORKS,

DONNINGTON, near NEWPORT, SHROPSHIRE; 8, FINSBURY CIRCUS, LONDON.

EDWARD E. CROMBIE & CO.,

INVENTORS AND PATENTEES

OF THE

FRICTIONLESS DRY GAS-METERS,

Beg to intimate to Gas Companies and others that they are now prepared to supply these very superior Meters at the same prices as for the ordinary Gas-Meters.

In the construction of this Meter, for which the best tin plates only are used, every mechanical contrivance has been taken advantage of successfully to reduce the friction to a minimum, which is amply proved by the fact that they are made to work upon only one-fortieth of an inch pressure. By an improvement also in their construction, a steadier light is obtained, and greater capacity than can be got from any other Meter in the market. No gas can pass under the valves on any back pressure, as is the case with many other Dry Meters.

To Gas Companies supplying gas through streets with heavy gradients, these Meters are invaluable, as much gas is saved from the low pressure required to work them.

ALL METERS ARE UPHELD FOR FIVE YEARS.

METROPOLITAN WORKS, DIANA PLACE, EUSTON ROAD, LONDON, N.W.

ROBT. DEMPSTER & SONS,

GAS ENGINEERS, IRONFOUNDERS, AND CONTRACTORS,

ROSE MOUNT IRON-WORKS, ELLAND, YORKSHIRE.

MANUFACTURERS OF EVERY DESCRIPTION OF

GAS APPARATUS;

CONTRACTORS FOR THE

ERECTION OF PUBLIC AND PRIVATE GAS-WORKS.

Plans and Specifications Prepared, and Illustrated Catalogues forwarded on application.

TRADE MARK

THE MEDAL FOR 1862.

The only Prize Medal awarded for TUBES & FITTINGS.

CROWN TUBE-WORKS,

WEDNESBURY, STAFFORDSHIRE.

WAREHOUSE: SOUTHWARK STREET, LONDON.

JAMES RUSSELL & SONS, LIMITED,

PATENTEES & FIRST MAKERS OF WROUGHT-IRON TUBES,

ONLY MAKERS OF HOMOGENEOUS METAL TUBES.

MANUFACTURERS OF

TUBES and FITTINGS for GAS, STEAM, and WATER;

LAP-WELDED, LOCOMOTIVE, MARINE, and other BOILER TUBES;

HYDRAULIC TUBES, BEDSTEAD TUBES, WELL TUBES, TELEGRAPH POSTS, COILS, &c.

GAS-FITTERS TOOLS, VALVES, COCKS, &c.

THOMAS PIGGOTT & CO.,

(Established 1822,)

SPRING HILL, BIRMINGHAM.

MANUFACTURERS OF

TELESCOPIC & SINGLE GASHOLDERS,

CAST & WROUGHT IRON TANKS FOR DITTO;

PURIFIERS, CONDENSERS, SCRUBBERS, RETORTS, VALVES;

IMPROVED WROUGHT-IRON RETORT-LIDS, CROSS-BARS, & SCREWS;

AND GAS APPARATUS OF EVERY DESCRIPTION.

SOLE MANUFACTURERS OF LIVESEY'S PATENT GASHOLDER MAN-LID,

By use of which Man-lid, inlet and outlet pipes can be examined and cleansed without loss of gas in crown of holder, or ingress of atmospheric air.

ROOFS, GIRDERS, BRIDGES, AND BOILERS OF ALL KINDS.

Drawings, Specifications, and Estimates supplied on application.

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GAS COAL. GAS COAL. GAS COAL.

WELLS, BIRCH, RYDE, and CO., Limited,

HOYLAND SILKSTONE COLLIERIES,

Near BARNSLEY.

This Company is now in a position to raise 2000 tons per day of REAL OLD SILKSTONE GAS COAL.

"The quality of this Coal for Gas purposes, if equalled, is not excelled by any on record, and the Coke competes successfully with best Durham."—See *Mining Journal*, Aug. 11, 1877.

Prices quoted to any Railway Station, or F.O.B. Hull, Grimsby, Goole, Keadby, Liverpool, and Fleetwood.

Full particulars will be sent on application to above address.

HONOURABLE MENTION. **J. E. WILLIAMS & CO.,** PARIS EXHIBTIION, 1878.

SOLE MANUFACTURERS OF THE

SPECIAL METALLIC OXIDE PAINT,

Largely used by Gas Companies, Corporations, Railway Companies, Ironfounders, and Machinists. It has the following qualifications and properties:—

EFFECTUALLY PREVENTS AND ARRESTS CORROSION.
HAS A FINE GLOSS, AND IS VERY DURABLE.
DOES NOT REQUIRE DRIERS LIKE OTHER PAINTS.
PROTECTS IRON FROM ACTION OF WATER.

IS NOT AFFECTED BY SULPHURETTED HYDROGEN.
FORMS A VERY HARD TOUGH (NOT BRITTLE) SURFACE.
WILL NOT CRACK, BLISTER, OR SCALE
IS NOT AFFECTED BY EXTREMES OF TEMPERATURE.

COVERS NEARLY DOUBLE THE AREA OF OTHER PAINTS.
(7 gallons or 1 cwt. will cover 1211 square yards of Ironwork.)
IS CHEAPER AND MORE ECONOMICAL THAN ANY OTHER.

VICTORIA PAINT WORKS, COLLYHURST, MANCHESTER.

HYDRATED PURIFYING MATERIAL.

Samples onapplication.

MESSRS. SPENCE BROS., LIMITED,

Will be glad to supply the above on the most favourable terms, and to treat, by Purchase or Exchange, for Spent Oxide.

PRICES ON APPLICATION.

ALSO PATENT DRY COPPERAS FOR EXTRACTING AMMONIA.

VICTORIA CHEMICAL WORKS, BRADFORD, NEAR MANCHESTER.

DANIEL HOWARD,

(Successor to the late BENJ. WHITEHOUSE),

GASHOLDER AND BOILER WORKS

WEST BROMWICH, NEAR BIRMINGHAM (Established 1765),

MANUFACTURER OF

TELESCOPIC AND SINGLE GASHOLDERS,

WROUGHT AND CAST-IRON TANKS FOR DITTO.

PURIFIERS, CONDENSERS, SCRUBBERS, HYDRAULIC MAINS, AND ALL KINDS OF GAS APPARATUS.

WROUGHT-IRON ROOFS, BRIDGES, GIRDERS, ETC.

STEAM, HOT WATER, AND RANGE BOILERS, TANKS, CISTERNS, BOATS,

AND ALL KINDS OF WROUGHT-IRON WORK.

Drawings, Specifications, and Estimates supplied on application.

GAS PURIFICATION

BY

OXIDE OF IRON.

GAS PURIFICATION & CHEMICAL Co., LIMITED,

PALMERSTON BUILDINGS, OLD BROAD STREET, LONDON, E.C.

JOHN WM. O'NEILL, Managing Director.

SAMUEL CUTLER & SONS,

CONTRACTORS FOR GAS & WATER WORKS, GENERAL ENGINEERS, IRONFOUNDERS & MANUFACTURERS OF

GASHOLDERS, TANKS, PURIFIERS,

SCRUBBERS, VALVES, EXHAUSTERS, IRON ROOFS, BRIDGES, BOILERS, AND GENERAL CAST AND WROUGHT IRON WORKS.

S. C. & SONS undertake the entire erection of New, or Remodelling of existing Gas-Works in any part of the World, including small Works for MANSIONS, FACTORIES, &c., or Works of the largest extent (are now constructing the largest Gasholder yet erected); also the supplying and laying of MAINS.

They make a speciality of supplying every requisite whatever for Gas-Works, keeping in Stock what are most in request. WOOD SIEVES for Purifiers and Scrubbers, of a superior make.

SPECIAL CASTINGS to Drawing or Pattern at Shortest Notice.

Manufacturers of MORRIS & CUTLER'S PATENT CONDENSER & CUTLER'S PATENT GAS-WASHER.

DESCRIPTION OF MORRIS & CUTLER'S PATENT CONDENSER.—The Condenser may consist of pipes arranged in tiers, or in any other form most convenient to the site available, each tier being connected with special connections, and containing within same either one or more coils of smaller pipe through which water is passed, being supplied from any convenient source of supply, the water passing in an opposite direction to the gas, so that the coldest water is at the gas outlet. The power of the Condenser can be regulated precisely in proportion to the quantity of water allowed to pass through, which is not in any way contaminated, but simply heated by the hot gas, and advantage can be taken of its being at a high level to carry it to a high-level cistern, from whence it can be used for supply to boiler or any other purpose. The Condenser itself may form the support for a high-level cistern. By an arrangement of valves the water may be shut off, and an air orifice opened, when air will pass through instead of water, or both air and water can be shut off. The power of the Condenser is, therefore, entirely under control. The Condenser may be seen in operation at the Brentford Gas-Works.

For further Particulars, apply to Mr. F. MORRIS, GAS-WORKS, BRENTFORD, or to S. CUTLER & SONS, PROVIDENCE WORKS, MILLWALL (Near the Steamboat Pier), LONDON, E.

1862.

CLASS II.

HALLETT'S
PATENT ANTIMONY PAINT.

MADE ONLY BY

GEORGE HALLETT & CO.,

296, ROTHERHITHE, LONDON, S.E.

Price 30s. per Cwt. Special Driers supplied at same Price.

This light stone-coloured Paint, for which a Prize Medal was obtained in 1862, is free from certain defects of white lead. It does not produce any deleterious effect upon the health of those who use it, such as painter's colic, nor is it blackened by sulphur compounds in the atmosphere; while, from its less specific gravity and good body, it covers more surface, weight for weight, and, therefore, it is preferable and more economical than white lead.

It is peculiarly adapted for Gas-Works.

GOLDSMITH'S PATENT SIGHT WATER-LINE INDICATING GAS-METER.

MANUFACTURED BY GUEST AND CHRIMES,

FOUNDRY AND GENERAL BRASS WORKS, ROTHERHAM;

AND 85, SOUTHWARK ST., LONDON, S.E.

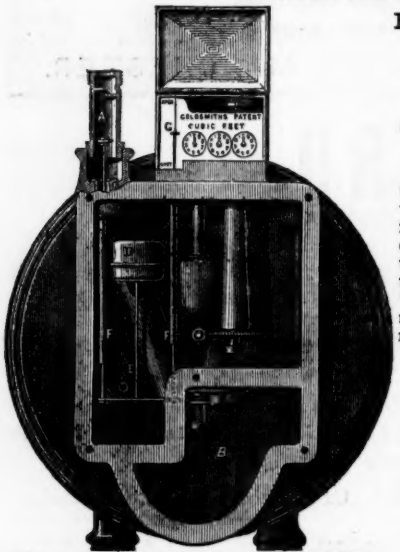


FIG. 1.—Three-light Meter, One-sixth Size

Fig. 1 is a Meter with front removed to show the arrangement and connection of the Indicator and Valve.

Fig. 2 is front view of Index, with cover up.

The principal object of this invention is to render the water-line in the reservoir at all times visible. It will be seen, by reference to the illustrations, that this is accomplished in the following manner:—On the dial are the words "Open" and "Shut," and attached to the float is the pointer G, which rises and falls with the water-line in the reservoir. If the pointer is at "Open," it shows that the valve is open, and that the reservoir is full. If it is at "Shut," it shows that the reservoir is empty, and that the gas will be shut off.

The following ADVANTAGES will be obvious:—

1. The Inspector can see at a glance if the Meter requires water.
2. No more water than is required need be added, and therefore no water has to run out.
3. The Meter Inspector will be spared a great deal of his most objectionable work, and he will save a great deal of time and trouble.
4. The consumer will not always have to be asked for water, nor will he have to endure the unpleasant smell caused by waste water being run out.

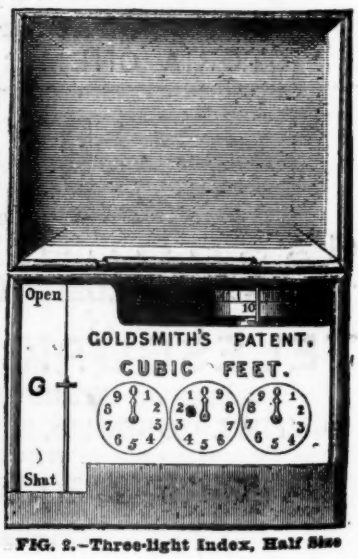


FIG. 2.—Three-light Index, Half Size

GEORGE ORME & CO.,

ATLAS METER-WORKS, OLDHAM,

MANUFACTURERS OF

WET AND DRY GAS-METERS,

STATION-METERS, GOVERNORS,

PRESSURE AND EXHAUST REGISTERS,

LAMP-METERS IN CAST-IRON BOXES,

And every Description of Gas Apparatus.

JAMES MILNE & SON,

GAS ENGINEERS,

Gas-Meter, Gas Apparatus, and Gas-Fittings Manufacturers,

EDINBURGH, AND

2, KING EDWARD STREET,

NEWGATE STREET, LONDON.

Meter Works in London—2, CROSS STREET, WILDERNESS ROW, E.C.

STATION-METERS GOVERNORS, CONSUMERS METERS, GAS LUSTRES, CHANDELIERS, BRACKETS, &c.,

And every description of Gas-Fittings and Gas Apparatus.

J. & J. BRADDOCK,

GAS ENGINEERS,

GLOBE METER-WORKS, OLDHAM,

MANUFACTURERS OF

WET & DRY CONSUMERS GAS-METERS,

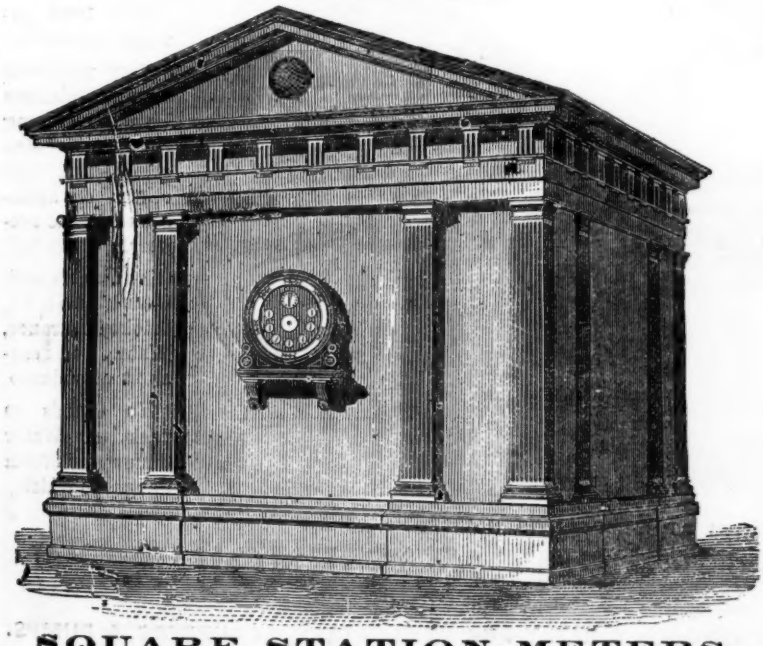
OF THE HIGHEST EXCELLENCE ONLY;

ALSO LICENSEES AND MANUFACTURERS OF

WARNER & COWAN'S PATENT SELF-REGULATING GAS-METERS;

ROUND STATION-METERS,

ON CAST-IRON STANDS.



SQUARE STATION-METERS,

WITH PLANED JOINTS.

GOVERNORS, GAUGES, INDICATORS, MAIN COCKS, &c.

GAS COOKING APPARATUS.

Home and Foreign Orders promptly attended to.

All Sizes of CONSUMERS METERS, STATION-METERS, and GOVERNORS generally in Stock.

Orders almost invariably despatched on the day of receipt.

TERMS, &c. ON APPLICATION.

C. & W. WALKER'S

WOOD PURIFIER SIEVES,

Which have now been used for fifteen years, and their advantages and durability fully established. They are made entirely by steam machinery in very large quantities at the most moderate cost.

MIDLAND IRON-WORKS,
DONNINGTON, NEAR NEWPORT, SHROPSHIRE.
FINSBURY CIRCUS, LONDON.

ESTABLISHED IN 1860.

BENJAMIN CARPENTER,

THE ORIGINAL MANUFACTURER OF THE IMPROVED

WOOD SIEVES

FOR

GAS PURIFIERS & SCRUBBERS.

PROVIDENCE WORKS,
22, HERMES STREET, PENTONVILLE ROAD,
LONDON, N.

MOBBERLEY & PERRY,

FIRE CLAY and BRICK WORKS,

STOURBRIDGE.

Proprietors of
BEST GLASS-HOUSE POT and CRUCIBLE CLAY.
Manufacturers for Home and Export.
GAS-RETORTS, GLASS-HOUSE FURNACE,
BLAST-FURNACE, TANK BRICKS, LUMPS, TILES,
And Every Description of Best Fire-Bricks.

JOHN ROMANS, C.E., F.G.S.E.,

CONSULTING GAS ENGINEER

AND

CANNEL COAL FACTOR,

30, St. Andrew Square, EDINBURGH.

Plans and Estimates furnished; Gas-Works, Apparatus, Pipes, Machinery, Fire Goods, &c., supplied, or Attested and Shipped for Exportation.

GAS-WORKS TAKEN ON LEASE.

Mr. ROMANS has for upwards of 30 years been practically engaged in the Manufacture of Gas, and has, by extensive experiments, ascertained that by JUDICIOUS INTERMIXTURE of the lighter with the heavier gases, much of the rich Hydrocarbons CAN BE SAVED, which otherwise ARE LOST, during the process of manufacture. He is therefore enabled to give advice to those who favour him with their orders for Cannel, as to the class which will secure for their standard of illuminating power the HIGHEST ADVANTAGEOUS RESULTS.

ANALYSIS AND PRICES FORWARDED ON APPLICATION.

GRIRDROD'S PATENT

PORTABLE PIPE SCREWING MACHINE,

For 1 in., 1¼ in., 1½ in., and 2 in. Gas Threads, complete £7 10s.

In use at the chief gas-works, and giving great satisfaction.

For other useful goods, see Bailey's "Illustrated Inventions," post free 3s. 6d.; gratis to ledger customers.

W. H. BAILEY & CO.,

Brassfounders, Gauge Injector and Tool Makers,
ALBION WORKS, SALFORD,
LANCASHIRE.

Gold Medal Awarded, Paris Exhibition, 1878.

THOMAS TURTON AND SONS,

SHEAF AND SPRING WORKS,

SHEFFIELD,

MANUFACTURERS OF

FILES OF BEST QUALITY

FOR ENGINEERS,

STEEL OF ALL DESCRIPTIONS,

SCREW STOCKS, TAPS, AND DIES, SPANNER RATCHET BRACES, LIFTING-JACKS, ANVILS, VICES,

AND ENGINEERS TOOLS GENERALLY.

LONDON OFFICE:

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R. W. WINFIELD AND CO.,

CAMBRIDGE STREET WORKS AND ROLLING MILLS,

BIRMINGHAM.

The following Medals have been awarded:—

GRAND COUNCIL MEDAL, LONDON, 1851. MEDAL, LONDON, 1862. GOLD MEDAL, PARIS, 1867,

The only Gold Medal awarded for "Apparatus and Processes for Heating and Lighting" by the Imperial Commissioners

MEDAL FOR PROGRESS, VIENNA, 1873.

The following Medals were also awarded at Paris, 1878:—

GOLD MEDAL for Chandeliers and Gas-Fittings.

GOLD MEDAL (Rappel) for Metallic Bedsteads and Furniture.

GOLD MEDAL (Rappel) for Art Metal Work. BRONZE MEDAL for Tube Metal and Wire.

MANUFACTURERS OF BRASS AND COPPER SHEETS,

TUBE AND WIRE,

ROLLED METALS, LOCOMOTIVE AND CONDENSER TUBES, CYLINDERS;

Ornamental, Taper, and Cased Tubes; Tin Tubes;

GAS-FITTINGS, CHANDELIERS,

BRACKETS FOR HEATING AND LIGHTING;

METALLIC BEDSTEADS.

Ecclesiastical and Mediæval Metal Workers.

GENERAL BRASSFOUNDERS.

REGISTERED TRADE MARK:

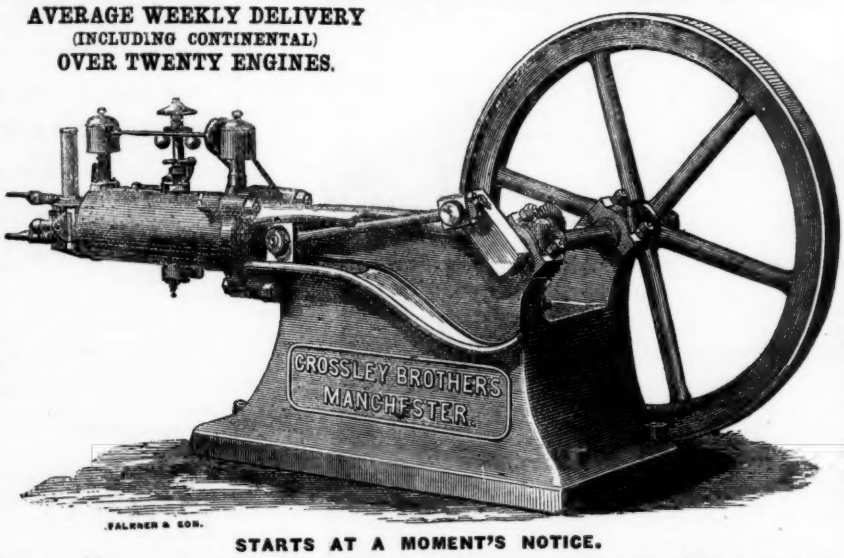
R. W. W. & CO.

LONDON OFFICES & SHOW-ROOMS: 141, FLEET STREET, E.C.

AN ENGINE WHICH WORKS WITHOUT A BOILER OR STEAM

AVERAGE WEEKLY DELIVERY
(INCLUDING CONTINENTAL)
OVER TWENTY ENGINES.

The durability of these Engines is now established by experience, one of them having run night and day at the Hinckley Gas-Works for over Twelve months without any expenditure for repair; this being equal to about 2½ years average work.



Over 1900 already delivered.

Very numerous Testimonials from Users, including Engineers, Men of Science, and others, on application to the makers.

No trouble with Coal, Ashes, Smoke, Insurance, Water, or constant attendance

No Glands to pack, or Water Gauges and Steam Gauges to watch.

STARTS AT A MOMENT'S NOTICE.

THE "OTTO" SILENT GAS-ENGINE.

(Otto and Crossley's Patents, 1876 and 1877,)

THEY ARE USED FOR ALL KINDS OF PURPOSES, CHIEFLY FOR EXHAUSTERS, SCRUBBERS, & PUMPS.

DELIVERED IN MANCHESTER. SIZES { NOMINAL HORSE POWER ½ 1 2 3½ 6 8 12 16 / MAXIMUM HORSE POWER ¾ 1½ 2½ 4 9 12 18 24 } OFFERED. CASES NOT CHARGED IF RETURNED FREE

PRICES INCLUDE CAST-IRON STAND, TURNED FLY-WHEEL, AND DRIVING PULLEY; WATER-VESSEL, SEVERAL DUPLICATES, AND GAS-FITTINGS (EXCEPTING METER AND PIPES).

WORKS AND HEAD OFFICES: Gt. Marlbro' St., Gloster St.

CROSSLEY BROTHERS, MANCHESTER.

LONDON HOUSE: 116, Queen Victoria St., E.C.

TANGYE BROTHERS AND HOLMAN,

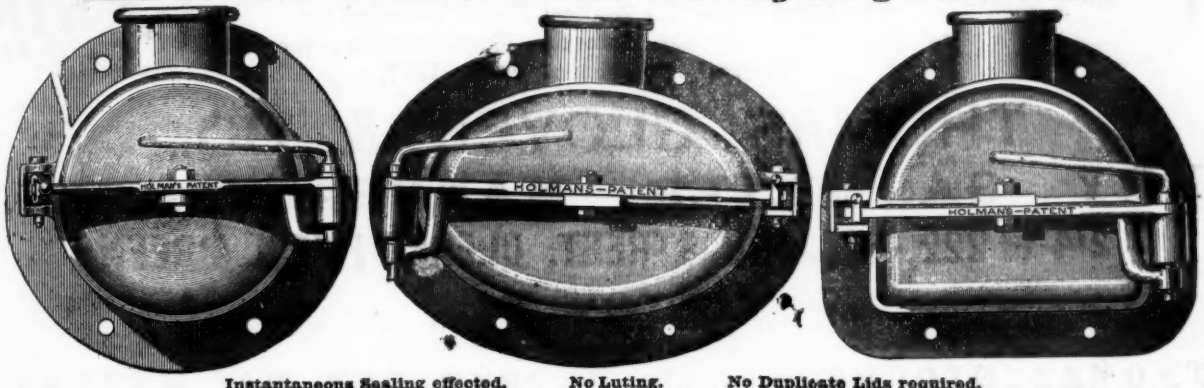
CORNWALL HOUSE, 35, QUEEN VICTORIA STREET, LONDON, E.C.,

(LATE OF 10, LAURENCE POUNTNEY LANE.)

SOLE MAKERS OF MORTON'S PATENT SELF-SEALING RETORT-LIDS,

WITH HOLMAN'S PATENT ECCENTRIC FASTENINGS,

Anti-Friction Catches, and New Self-Adjusting Cross-Bars.



Instantaneous Sealing effected. No Luting. No Duplicate Lids required.

Holman's New Self-Sustaining Cross-Bar ensures freedom of Joint, and maintains parallel position of the Lids.

Since their introduction in 1869, these Patent Retort-Lids have been thoroughly tested, being now in use in nearly all the principal Gas-Works in London and the Provinces.

T. B. and H. are now making the "Morton's Self-Sealing Lid" of the SAME FORM OR SECTION AS THE RETORT (see Illustrations above), as well as bringing the Mouthpiece from the D or Oval at back to Circular in front, as heretofore.

D and Oval Morton's Lids are working satisfactorily both in this country, on the Continent, and in the United States of America. Among others they have been adopted by the following Gas-Works:—

The Gaslight Company's Works, Fulham; Ditto, Bromley-by-Bow; Ditto, King's Cross; Ditto, Shoreditch.
And also in the Gas-Works at Richmond, Maidstone, Gloucester, Glasgow, Portsea, Roubaix (France), The Hague (Holland

HUNT'S PATENT EQUILIBRIUM GAS-GOVERNOR.

In this Governor a Throttle-Valve is substituted for the ordinary suspended Cone, all external communications being avoided by placing the Lever or Radius Arm (shown in the drawing) inside the Valve-Chamber upon the Disc. The Disc is carried upon steel centres, upon which it is accurately balanced and turns freely. The friction in working is thereby reduced to a minimum. This Governor is extremely sensitive to alterations of inlet or outlet pressure, and renders a large actuating holder unnecessary.

The principal advantages of this arrangement over the ordinary form of Governor are as follows:—

Its sensitive action prevents oscillation.

It is self-adjusting—*i.e.*, it maintains a steady pressure under variations of inlet pressure or a fluctuating consumption.

The inlet to Gasholder being contracted to the smallest possible dimensions, all danger from leakage through insufficiency of seal, tilting, &c., is entirely avoided.

The valve portion being separate from the holder, it can be handled and fixed like an ordinary Slide-Valve direct in the main; and the holder can be placed at an convenient distance immediately above it. The cost is thus materially reduced, and the inconvenience of heavy lifts done away with.

There are no working parts likely to get out of order.

These Governors have been adopted by many leading Gas Companies, among whom are the following:—

The Gaslight and Coke Co. (9), The London Gas Co. (3), and at Abergavenny, Arundel, Birmingham, Cannes (France), Devonport, Dursley, Exeter, Guernsey, Halesowen, Mentone (France), Monmouth, Newcastle-on-Tyne, Oxford, Plymouth Rochdale, Windsor, &c.

TESTIMONIAL.

The Gaslight and Coke Company,
9, Water Street, New Bridge Street,
Blackfriars, E.C., Feb. 27, 1875.

MESSRS. TANGYE BROTHERS AND HOLMAN.

Gentlemen,—The two 24-inch and three 36-inch Hunt's Equilibrium Governors supplied by you, and fixed in the valve-rooms at Whitechapel, Goswell Road, and Blackfriars, are working very satisfactorily.

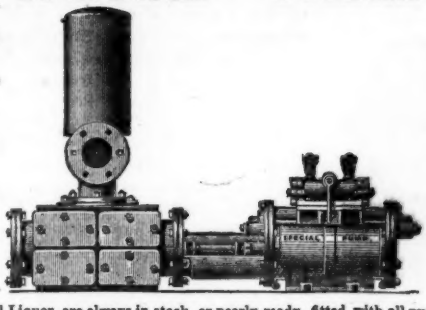
Yours truly,

(Signed) JOHN JOHNSON.

PRICES AND FULL PARTICULARS ON APPLICATION.

THE "SPECIAL" STEAM-PUMP.

Diameter of Steam Cylinder.	Diameter of Water Cylinder.	Length of Stroke.	Gallons of Water per Hour, Approximate.	Reduced Prices.
3	1½	9	450	£16
4	2	9	815	18
5*	2½	12	1,250*	20
5*	3	12	1,830*	22 10
4	4	12	3,250	25
6*	4	12	3,250*	30
5	5	12	5,070	32 10
7*	5	12	5,070*	40
6	6	12	7,330	40
8*	6	12	7,330*	50
7	7	12	9,750	50
10*	7	12	9,750*	65



In use in a Hundred Gas-Works in the United Kingdom for Pumping Ammoniacal Liquor, Water, or Tar.

Messrs. Burt, Boulton, and Haywood, Manufacturing Chemists, have over FORTY "Special" Steam-Pumps in use at their several large Tar-Works.

Two Hundred Sizes made. Those in Table opposite are the leading Sizes for use in Gas-Works and Chemical Works.

These Sizes being usually selected for pumping Tar and Liquor, are always in stock, or nearly ready, fitted with all pump details in iron, and extra length distance-piece between steam and pump cylinder, at a small extra cost.

TANGYE'S HIGH-PRESSURE AND CONDENSING STEAM-ENGINES; CORNISH, VERTICAL, & TUBULAR BOILERS; HYDRAULIC AND SCREW LIFTING-JACKS, CRABS, PULLEY-BLOCKS, &c.

FULL PARTICULARS, ESTIMATES, CATALOGUES, ETC., ON APPLICATION.

London, 1851. New York. 1853. Paris, 1855. London. 1862.

Dublin, 1865.

The SIX MEDALS AWARDED to THOMAS GLOVER for

PATENT DRY GAS-METERS,

The latter being the Highest Medal awarded for Dry Gas-Meters bv the Imperial Commissioners for the Universal Exhibition, Paris, 1867.

Paris, 1867.

THOMAS GLOVER & CO.,

DRY GAS-METER MANUFACTURERS,

214 TO 222, ST. JOHN STREET, CLERKENWELL GREEN,

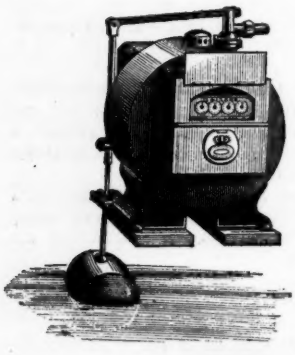
LONDON, E.C.

THOMAS GLOVER & CO.'S PATENT DRY GAS-METERS.

1st, Are a remedy for all the defects of Wet Meters;
2nd, Are suitable for all climates, whether hot or cold;
3rd, Incur no loss of Gas by evaporation;
4th, Cannot become fixed by frost, however severe;
5th, Are the most accurate and unvarying measurers of Gas;
6th, Prevent jumping or unexpected extinction of the Lights;
7th, May be fixed either above or below the level of the Lights;
8th, Cannot be tampered with, without visibly damaging the outer case;
9th, Will last much longer than Wet Meters;
10th, Will not cost more than one-half for repair that Wet or Water Meters do;
Are upheld for five years without charge.

WILLIAM PARKINSON AND CO.

(ESTABLISHED 1816.)



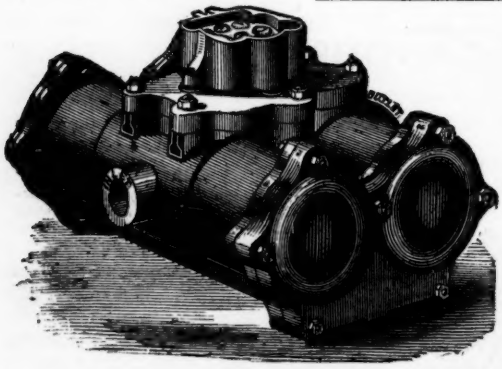
SOLE MAKERS OF THE LOW-PRESSURE WATER-METER.

This Meter will register with perfect accuracy, either at full speed, or with a few drops only passing through it.

It must be placed over the cistern to be supplied, and the water, after being measured, will fall from the outlet into the cistern below.

Each Meter is fitted with a ball-valve, so made that it can be adjusted to shut off the supply at the inlet when the water reaches any required height in the cistern.

The 100-gallon Meter is fitted with a cistern holding about three or four gallons, and may be fixed inside a house, free from the effects of frost, and requires no attention after once being fixed.



HIGH-PRESSURE WATER-METER.

The Union Water-Meter, of which an external view is here given, is of the positive class—*i.e.*, a Meter in which a measuring chamber is alternately filled and emptied, each filling being duly recorded. It is formed of two cylinders, with double pistons in each, having a rotary-valve of peculiar construction, which is worked from cams on the piston-rods.

It is claimed for this Meter, among its advantages over other Piston Meters in use, that it is extremely small and compact, and that its durability and accuracy have been proved by the fact that upwards of 20,000 of them, of various sizes, are in successful operation in the States. In England the instrument has been fully tested by several Water Engineers of eminence, and pronounced by them as a reliable and satisfactory register of water supply; it is also economical in cost.

ALL METERS are TESTED with 60 lbs. pressure before they are sent out.

COTTAGE LANE, CITY ROAD, LONDON, E.C.

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TO CORRESPONDENTS.

No notice can be taken of anonymous communications. Whatever is intended for insertion, must be authenticated by the name and address of the writer; not necessarily for publication, but as a guarantee of good faith.

THE JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, APRIL 29, 1879.

Circular to Gas Companies.

We are very sorry to see it announced that the Bill promoted by The Gaslight and Coke Company has been withdrawn. It was a measure intended and calculated to benefit the consumer. For the moment, we set aside the fact that one object was to give magistrates a discretionary power in settling the amount of forfeitures for defects. We are not lawyers, but as we are we do not remember any other case in which a fixed and rigid rule is laid down for the direction of a magistrate in apportioning a fine. In every case of a fault, circumstances more or less extenuating may be urged, and, whatever they may be, the Bench should give them their full weight. The great objection raised against the Bill was what has been denominated the "inquisitorial" powers that it would confer. The Company asked for power to enter consumers premises and inspect fittings, and, if these were found to be not of a quality to answer the consumer's purpose, to remove and replace them with such as would do justice both to the gas and to the consumer. It is acknowledged in our police law that people want protection against themselves and their folly, and no class of persons that we know of so much require protection as gas consumers. It is absurd to suppose that the Company had any sinister intents on the consumers pockets. The steps they proposed to take would, if carried out, have led to a large saving in the consumption, which would certainly not have been to the Company's interest. So long as the gas passed through the meter, it would be to a Company's interest to encourage waste; but this it was the object of the Bill to prevent, in two directions. One, the leakage from ill-constructed fittings; and the other, the indirect waste which results from the use of bad burners. The measure, as we have said, has been lost for this session; but one of a similar character will certainly be passed before many years are over. We have said nothing about the supply of cooking and heating appliances. The decision in the Great Eastern Railway case, we may take it, leaves it open to a Company to employ their capital in the best way they can, always supposing that they adhere to their special business.

The electric light continues to be what we may profanely call a bugbear. It has, of course, its uses and recommendations; but when gas shareholders look on it with alarm, they betray much simplicity of mind. All authorities on the matter concur in expressing an opinion, that gas can hold its own against all competitors. We are alive to the fact that great improvements may be made in the distribution of electricity, by which means advantages may be gained, which are not now attainable, in the lighting of closed and divided spaces. Such discoveries, however, at the present moment, look distant. The gentleman who was to revolutionize the art of illumination has now issued his English patent, and that most bitter enemy of Gas Companies, *The Times*, admits, after a fair description of Mr. Edison's specification, that, "In the presence of a specification which can thus be summed "up, it seems tolerably certain that the proprietors of gas shares "may possess their souls in peace, and that the general introduction of electric lighting must be deferred until some more "solid progress has been accomplished."

In the current number of the *Edinburgh Review* will be found an article of some interest, founded on a work by Mons. H. Fontaine, which gives a good account of many of the machines by which electricity is generated, and the means by which it is distributed. Mons. Fontaine himself is by no means sanguine that electricity will ever come into general use as an illuminant, and, in supporting this conclusion, he quotes Dr. Siemens, who is, perhaps, the highest authority on the subject—not excepting Mr. Edison. That gentleman says, although he is of opinion "that electricity will *gradually* replace gas in many of its most "important applications, as being both cheaper and more "brilliant," its use will, in our generation, be confined to the lighting up of our coasts, large spaces, halls, and, perhaps, picture galleries. On this we may remark, that he will be a clever man who lights up the National Gallery and the picture-rooms at South Kensington by means of electricity. As regards its use in the Navy, about which a good deal is now being said, we may take it that its employment will have as many objections as advantages. In the mercantile marine, in which simply a warning light is required, the recommendations are incontestable, although it is probable that collisions will be as frequent as ever.

There is some sound sense in what the Edinburgh Reviewer says, with regard to the comparative cost of electric and gas illumination. He points out that when electricity is used, a good deal more light is produced than is required for a particular purpose, and thus a great waste is incurred. Illumination by means of gas can be regulated with the utmost nicety, and not a single foot of it need be uselessly consumed. That light stimulates labour may well be admitted, and we have no doubt that men working at night under the brilliant effulgence of an electric lamp will do more work than when labouring under the duller radiance of gas. There may be more reasons than one for this, and perhaps it would be wrong to lay too great stress on the stimulating properties of the electric light when manual labour is implicated. Gas, well distributed, we now know will produce as effective an illumination as electricity, without causing the unpleasant glare which results when the latter is employed. The writer in the *Edinburgh Review* appears to entertain no expectation that electricity will ever become a common domestic illuminant, when he says: "And, if last, not least, in that "divided form it will become a cherished accession to the "gathering of other bright things in the dwellings of the "wealthy, where elegance and luxury take rank as necessaries "of life, and where high cost is a recommendation rather than "a disqualifying condition."

The policy of Gas Companies at this juncture—we cannot call it crisis—is clearly pointed out. It is to push the employment of gas for other than illuminating purposes. Although, as we have repeatedly said, gas has nothing to fear, in its chief citadels, from the competition of the electric light, even in the homes of the masses it is susceptible of a much more extensive use, and nothing but encouragement is wanting to make it the common domestic fuel.

We are sorry to learn from our correspondent in the North that the strike of the Durham miners is likely to continue for

some weeks longer. Masters and men are equally determined, and the struggle will be fought out to the bitter end. It may or may not last long, but the results to Gas Companies—or rather coal contractors—must necessarily be disastrous. At the present moment the stocks at the gas coal pits are exhausted, and ships have gone to other than Durham ports for southern loadings. Good gas coal is, of course, to be found outside the Durham districts, but the contractors who have relied on a supply from these mines must be placed in great difficulties. Some of the Metropolitan Companies, who are relying on a supply from Durham, will perhaps suffer from a temporary famine. We may be certain the strike cannot endure, for in a short time the miners must succumb to hunger.

Complaints are continually made against nuisances caused by Gas Companies, more especially when the utilization of residual products is conjoined. Strictly speaking, when the manufacture of residual products is properly conducted, no real nuisance results; but there are always invalids, for whom we have the greatest sympathy, who regard a bad smell with the greatest antipathy, without reflecting that at the same time the substance producing it may be the most beneficent of antiseptic agents. Complaints come from Brighton, which must be regarded as without foundation. For our own part, we are glad that the Brighton and Hove General Gas Company have succeeded with their Bill, and hope that they will continue in a hopeful and prosperous course.

We are requested to contradict the statement we made last week that the Norwich station of the British Gaslight Company, Limited, had a nearly full reserve-fund. The fact, we are told, is, that there is no reserve-fund at all at Norwich, and this, for one reason, tends to enhance the price of gas in the city. But, notwithstanding the absence of a reserve, the Directors have resolved on reducing the price of gas, from and after the 31st of March last, to 3s. 9d. per thousand feet, which, when the usual discounts have been granted, will make the price to large consumers 3s. 4½d. per thousand. The British Gaslight Company are notorious for behaving with the greatest liberality to their consumers. The Town Council of Hull, who are, of course, at loggerheads with all the Gas Companies supplying their district, have no fault to find with the British Company, who supply them with excellent gas at a much cheaper rate than any of their neighbours. It is a most unfortunate circumstance that a town like like Hull should be served by three Gas Companies. A wise policy would years ago have welded them all into one compact undertaking. What has stood in the way of union we do not know, but feel satisfied the astute officials of the British Company would have offered no opposition to the combination. Speaking here with perfect candour, we may say that gas affairs in Hull cannot long remain as they are. There is no other instance in England in which a town like Hull is supplied with gas by three statutory Companies. Let us sincerely hope that before next November the Companies will have made up their minds to enter into a union, and so settle many of the disputes which arise between the Town Council and the Gas Companies. The question of purchase will, of course, crop up from time to time, but the simple fact is that the Corporation of Hull are impecunious, and would probably find a difficulty in raising the money for the purchase of the undertakings. It will take a great deal of trouble to arrange gas matters, unless, as we are anxious to see, the Gas Companies combine under the ægis of the British Company.

The Select Committee on the Electric Light commenced their sittings on Friday last, and began, first of all, with an examination of all the machinery which has been invented for the production of the light. After that, Professor Tyndall gave evidence; but what he said leaves Gas Companies in the same position, with regard to the electric light, as they are at present. Professor Tyndall is the great exponent of scientific progress, and his attainments command respect, which no other man in the English scientific world can equal.

The undertaking of the Lancaster Gas Company may be regarded as having passed into the hands of the Corporation. Considering all things, the terms of purchase cannot be said to be bad. The capital of the Company is £30,000, and the amount of purchase-money agreed upon, subject to the sanction of the ratepayers, is £80,000. The mortgage debt of £7000 is, of course, to be taken over by the Corporation. What other arrangements have been made we do not know; but if this contract be carried out, another Gas Company will disappear from commercial circles. In this case no one will be benefited by the transfer. The Shareholders will fare tolerably well, but the price should have been higher. The bargain is, however, as we have said, not concluded, and time is left to modify the terms.

Improved gas lighting for the illumination of public spaces is, we are happy to see, spreading. The Corporation of Salford have placed a few of Mr. Sugg's burners and lanterns in prominent positions, and their effect is recognized as being extraordinarily good. We may just mention, in passing, that it is in the case of Corporations possessing gas-works that these lights may be most properly introduced. In towns where Gas Companies exist, the ratepayers will, of course, object to pay for extra illumination; but considering the circumstances of the Salford Corporation with regard to their gas-works, they can well afford to give the inhabitants the benefit of all recent improvements. They were the first corporate body in the kingdom who possessed gas-works, and they may as well continue to keep the lead in introducing the best appliances for the employment of gas.

The Sheffield Gas Company are, with the consent of the Corporation, now exhibiting the improved gaslights in several prominent positions in the borough. It is hardly necessary to say that the Company are at present doing this at their own expense. Whether, when every ratepayer's eye has been gratified by a sight of the exhibition, the Corporation will agree to pay the small additional cost which must be charged for increased illumination, remains to be seen.

The exhibition of gas appliances at Leeds has been opened with much success. The fear that damage would be done to the decorations of the Victoria Hall, by the combustion of so much gas, seems to have disappeared, and no one now dreams that mischief will be done by the most useful exhibition ever held within its walls. According to the reports we have received, the exhibition is of a most complete character, and the arrangements reflect great credit on Mr. H. Woodall, the Gas Engineer of the Corporation, who has had the management, and who was, indeed, the originator of the scheme.

A smart correspondence has been going on in a Limerick paper respecting gas affairs in that city. The management by the Corporation evidently does not give satisfaction. As regards the actual Manager, it is admitted that his work is done with skill, energy, and honesty, but whenever the Gas Committee step in, it seems that matters go wrong. The accounts appear to be badly kept, and, as a matter of fact, the works seem to have been maintained by subsidies from the Corporation funds. Under these circumstances, it is not to be wondered that they experience great difficulty, and, indeed, find it impossible to borrow the money necessary to take over the works of the United General Gaslight Company.

Water and Sanitary Notes.

THE meeting of the Vestry and District' Board Delegates has resulted in passing a resolution to memorialize the Home Secretary, with a view to induce the Government to take up the question of the Metropolitan Water Supply. In the absence of that amalgamation among the Water Companies which we have so strongly advocated, only two courses are open. The Companies may be bought up, and the management of the undertakings be delegated to a conjoint committee of the Corporation of the City of London and the Metropolitan Board of Works. This could not be regarded as satisfactory either to the Government or to the Metropolitan ratepayers. The Board of Works are not in popular favour, and the Corporation of London are not likely to be entrusted with the administration of such an undertaking as the United Water Companies would constitute. There is the other proposal that the undertaking should be handed over to the management of a Government Commission. There is a sort of speciousness about this latter recommendation which will commend itself to many minds, for the sake of its apparent simplicity. Nothing would be easier than to transfer the undertakings, with the understanding that the Shareholders were to be paid their full annual dividends, and that the water supply should be maintained as it is. But this would not satisfy the agitators, who are wishful to see an entirely new supply of water furnished to the Metropolis. For this the inhabitants would have to pay a good round sum, and we notice that to this some of the Vestries are strongly averse. These bodies recognize the fact that the Metropolis is now very efficiently supplied by the Companies, and they object to any expenditure which is likely, in the long run, to make an addition to the present burthens. After all that has been said, it is admitted that water is cheap in London, and that any change in the administration is not likely to make it cheaper, or the supply more efficient. It is, however, a matter which rests mainly with the Companies themselves, who, by amalgamating, might remove many of the objections which are now brought against the service.

The "Annual Summary of the Births, Deaths, and Causes of

"Death in London and other Large Cities, for 1878," has just been issued. From this we learn that the average death-rate in the Metropolis during the past year was 22·8 per 1000. It is worthy of remark that these numbers differ but very little from those which have been recorded in the Annual Reports of the Registrar-General, since his office has had an existence. Beyond all doubt, many sanitary improvements have, in the meantime, been carried out; but no one can allege that any serious impression has been made on the rate of mortality. It must, however, be freely confessed that their agency has been valuable, and we accept the fact without hesitation, that improved drainage has kept down the mortality when increased density of population might have caused it to rise. For this reason we are grateful to the authorities who, by improving our sewerage, have lessened, to some extent, the danger of a spread of disease. The Registrar-General points out that the sewerage of the Metropolis is still imperfect. The branch sewers, which it is the duty of the Vestries to make, are still incomplete, and no activity is shown to perfect the system. The work, however, is going on, and London will, in the course of a few years, be most completely sewered. What effect this will have on the mortality we shall not attempt to predicate. The Registrar-General still complains that London is mainly supplied with the "polluted" water of the Thames. It is curious to note that, notwithstanding this fact, the same authority boasts that the death-rate is steadily decreasing. Supposing water to have anything to do with the causation of disease, the death-rate should go on increasing; but we know that it does not.

The Registrar-General, or whoever writes for him, continues his attacks on the Metropolitan Water Companies. This time, however, we are bound to say that an amount of fairness is indicated with which we have not always been able to credit the department. It is candidly admitted that the Gas and Water Companies have done good service to the public, and that the profits earned by risky concerns have not been at all exorbitant. Gas, it is intimated, may be extinguished any day, and the present water supply may be at any time superseded by the soft water from Wales, or the hard water from the London chalk. Thus it will be seen that the Shareholders of the Gas and Water Companies run an immediate risk of loss of profit from their investments. The Registrar-General correctly puts down the sum of money invested in Gas and Water undertakings in this Metropolis at £23,860,004; but he avoids any allusion to what would be required to buy up the Companies. He says, what is no doubt true, that the Metropolitan Board of Works could raise the money to take over the undertakings at about four per cent., but does not tell us who would be benefited by the transfer.

We have mentioned the fact that the cause of a somewhat severe outbreak of enteric fever at Caterham and Redhill had been traced to the water of the Caterham Company. We have now before us the report of Dr. Thorne, one of the Medical Inspectors of the Local Government Board, which, if not quite convincing, strongly supports the allegation. It is too long for abstract in this column to-day, but for the information of Water Companies and Corporations we may just point out the lesson conveyed. It is, never to allow a man with violent diarrhœa, and a pressing necessity for frequently relieving his bowels, to work in a well. The story is not so clear as it might be, but we have the undisputed fact, that a man affected with severe diarrhœa, whose evacuations may or may not have found their way into the water, was working in an adit being made to connect two of the wells of the Caterham Company. Whether or not he had true enteric fever is not made out; but, in any case, it argues carelessness on the part of employers, who allowed a man in such a condition to work for several hours at a stretch down a deep well. The story is of so much interest that we may possibly return to it when more space offers.

Presentation to Mr. J. O. N. Rutter, of Brighton.—On Saturday, the 19th inst., a handsome testimonial was presented by the workmen in the employ of the Brighton (Old) Gas Company, to Mr. J. O. N. Rutter, the for many years highly respected Superintendent, as a mark of the estimation in which he is and always has been held by them. The testimonial consisted of a splendid sixteen-day black marble striking-clock, with visible escapement, ruby pallets, striking hours and half hours, with plate bearing the following inscription:—"Presented to J. O. N. Rutter, Esq., by the workmen of the Black Rock Gas Company, as a token of their esteem, on the 80th anniversary of his birthday, April 19, 1879." The presentation was made on behalf of the workmen by Mr. John Howard, foreman of the meter department, in a suitable address; to which Mr. Rutter, who was much overcome by the totally unexpected and spontaneous compliment, responded briefly, but in feeling terms, in acknowledgment of the gift, and of the kind feeling by which it was prompted.

Cobham Gas-Works.—Last Tuesday these works were offered for sale by auction, at the Mark, Tokenhouse Yard. There was included all the necessary offices and out-buildings, the whole covering an area of about a quarter of an acre of ground, together with the plant and fixtures, with possession. The property adjoins the village on the high road to Sunningdale, being about three miles from the Woking and Sunningdale stations on the London and South-Western Railway. The highest bid was £380, and the property was bought in at £550.

A TREATISE ON THE SCIENCE AND PRACTICE OF THE MANUFACTURE AND DISTRIBUTION OF COAL GAS.

CLXXVII.

THE TREATMENT OF RESIDUAL PRODUCTS.

Anthracene ($C_{14}H_{10}$).

This substance, which has become of such great importance in consequence of Graebe and Liebermann's discovery that it can be converted into alizarine, was discovered by Dumas and Laurent in 1832. They gave it the name of Paranaphthalene. For nearly forty years it remained a mere chemical curiosity, and now it is one of the most important of the coal-tar products. Its formula is $C_{14}H_{10}$. It boils at about 360° C. = 680° Fahr., and it melts at 213° C. = 415° Fahr. Its boiling point shows at once that it is one of the least volatile of the products obtained in the distillation of tar.

According to Auerbach,* who is, perhaps, the highest authority on the subject, anthracene is not contained, as such, in coal tar; but is produced by the splitting up, during distillation, of a more complex hydrocarbon, probably of the formula nC_7H_6.

There are two processes by which anthracene may be prepared by the tar distiller; but it must be remembered that, as at first obtained, it is in an exceedingly impure condition. The two processes to which we allude are—firstly, to push the distillation of green tar to the point at which anthracene is formed and comes over, and the second is to distil soft pitch.

Separation of Anthracene from Green Tar.—We have so minutely described the various methods of distilling tar and heavy oils, that the attentive reader will have no difficulty in following the directions to be given. We have stated that when tar is distilled over the naked fire, two points are reached when the product distilling deposits a solid on a glass plate. The first is the naphthalene stage; at the second one, the substance contains anthracene. There are advantages, especially if the weather be cold, in allowing the distillate to remain in tanks for some time—in fact, as long as may be convenient—to allow the anthracene, which is dissolved in the accompanying oils, to crystallize out. It is obvious, however, that the period of repose must not be allowed to reach the time of hot weather.

When it is believed that the anthracene has settled out as much as it will, it is to be introduced into a hydro-extractor or centrifugal machine, to remove, as far as possible, the oily impurities. The centrifugal machine, however well worked, still leaves much oil. It frequently happens that the crude anthracene is so soft as to pass through the lining of the machine; in which case, a filter-press, such as Dehne's or Needham and Kite's, may be employed with advantage. Before being pumped into the press, the crude anthracene must be warmed to 40° C. = 104° Fahr.

In either case, it must afterwards be subjected to the hydraulic press, preferably one which has iron plates capable of being warmed. Gessert (*Ding. Polyt., J.* cxevi. 543) prepares anthracene containing 95 per cent. of real anthracene as follows:—He takes the "green grease"—*i.e.*, the portion of the distillate from tar which comes over at the second solidifying stage—and removes the adhering oil by a centrifugal machine. He then heats it to 40° C. = 104° F., and subjects it to hydraulic pressure, or sends it through a filter-press. The pressed cake, which contains about 60 per cent. of real anthracene, is boiled out with coal or petroleum naphtha; it is then again passed through the filter-press, and the cakes are finally fused.

Calvert states that the cake, when hot-pressed, contains 70 per cent. of anthracene; but, if cold-pressed, only 40 per cent. As the liquid which comes away during the process of hot-pressing contains some anthracene, it is proper to store it again as long as possible, in order to let it deposit. A good plan is to run it into tanks, and, when the creosote oils are required, to leave the thick at the bottom, and again fill up with the "press oil." After a time the tank can be emptied, and the thick portion be put through the filter-press.

Preparation of Anthracene from Soft Pitch.—The first persons, as far as the writer's knowledge extends, to prepare crude anthracene from soft pitch, on the large scale, were Messrs. George Miller and Co., tar distillers, of Glasgow. In the course of some important experiments which they were conducting, more than 20 years ago, upon lubricating oils, they pushed the distillation of boiled tar until the orange vapour which, as we have said, contains chrysene, pyrene, and other substances, came over freely. They then introduced the semi-solid products into an open iron pot, set in brickwork in a moderate sized room. The fireplace opened outside, so that there was no danger of explosion. The pot was then heated, until it was considered that all volatile products had been sublimed into the room. The writer happened to be present when the door was opened, and a truly extraordinary sight presented itself. The floor, the roof, and the sides of the room were covered with a thick layer of a crystalline yellow powder. Messrs. George Miller and Co. most kindly presented the writer with a keg of this powder for examination. Circumstances connected with the pressure of other investigations rendered it impossible for him to commence working upon it at once; he therefore gave the powder to Dr. Anderson, who at once entered upon its study. He soon found its principal ingredient to be Laurent's anthracene, and discovered an easy method of preparing oxyanthracene, the anthracenuse of Laurent, and anthraquinone of Graebe and Liebermann.

Dr. Anderson undoubtedly, therefore, takes an important place on the roll of those discoverers whose researches have led, step by step, to the artificial production of alizarin from coal tar.

Kopp directs that the distillation of the tar is only to be pushed

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* "Anthracen," by G. Auerbach; translated by William Crookes. London: Longmans. 1877.

to the point which we have indicated in describing what we have termed the "English System," where the naphthalene stage has been succeeded by heavy oils, which do not solidify on the glass plate. The residue in the still is, at this stage, what is termed soft pitch. The latter is then to be transferred to a shallow still. The head of the latter must be wide, and reach within 8 inches of the surface of the pitch in the still. As we have mentioned, in describing the "French System," the water in the worm tubs is to be hot at the commencement of the distillation, and afterwards it is to be kept boiling. This is, of course, to prevent the vapours from solidifying and stopping up the tubes. The exit of the heavy, and therefore sluggish vapours, is to be assisted by a current of superheated steam or air deoxygenized by passing through a red-hot tube filled with charcoal. We unhesitatingly prefer the former.

The still is so arranged that the level of the pitch can be kept almost constant. For this purpose, a vertical tube of convenient diameter passes through the dome of the still down into the pitch to half its depth. It must have an arrangement for opening or closing at its upper end. By means of a "dip stick," the level of the pitch in the still can always be ascertained, and more added as desired.

Care must be taken that too much of the orange vapours, to which we have so frequently alluded, is not allowed to pass over, as they greatly interfere with subsequent purification of the anthracene.

The preparation of anthracene from pitch, by carrying the distillation so far as to leave nothing but coke in the still, has engaged the attention of several chemists. Versmann, Fenner, Greiff, and others, have occupied themselves with this question; but, as pitch anthracene contains much chrysene and other substances very difficult to remove, it is looked upon in commerce with disfavour; it will not, therefore, be necessary, in this short sketch, to describe their processes.

Purification of Crude Anthracene.—The anthracene prepared as above is exceedingly impure. It is to be distilled in a current of superheated steam until chrysene and pyrene make their appearance. The anthracene towards the end appears as a crystalline powder.

When the distillation is finished, the product should, as we have said when dealing with it in the earlier stage of the manufacture, be allowed to repose. It may then be passed through a filter-press, and the cakes so obtained be hot-pressed. The temperature of the plates may be a few degrees higher than we advised with the crude anthracene from green tar. The press oils are to be treated as directed in the previous case.

The hot-pressed cakes are then to be finely pulverized, and treated with the medium oils we have described under the "French System." If the crude anthracene contains 25 per cent. of real, it is treated thus: The anthracene and about a quarter of its weight of medium oils are put into cylinders with agitators; the latter are rotated for 24 hours. The mixture is then put through a filter-press, which will allow of all the naphtha being removed. The cakes are treated in the hydraulic press. It should now contain about 30 per cent. of anthracene.

Anthracene which contains from 25 to 50 per cent. of real is to be ground to an impalpable powder, and treated, as before, with its own weight of naphtha in the cold for 24 hours. It is then to be passed through the filter-press, and the naphtha removed. It is then once more pressed to the utmost in the hydraulic press.

The anthracene, as thus purified, is finally to be sublimed in a current of superheated steam.

Determination of the Value of Anthracene.—A vast number of processes for the determination of the value of crude anthracene have been published at various times. Auerbach (*loc. cit.*) has examined all the proposed processes with great care, and comes to the unhesitating conclusion that Luck's method is the only one reliable. The following is an outline of it. Luck finds that pure anthracene yields almost exactly the theoretical amount of anthraquinone when dissolved in glacial acetic acid, and boiled with three or four parts of chromic acid; instead of 100, he obtained 99·4 per cent. When 0·447 gramme of anthraquinone was dissolved in glacial acetic acid, and three or four parts of chromic acid were added, and the mixture was boiled gently for two hours, on dilution with water 0·446 gramme was obtained. This is equal to 99·89 per cent., and shows that, under the conditions given, anthraquinone is unacted on.

The compounds which come over in distillation along with anthracene, such as chrysene, pyrene, &c., on sufficient treatment with chromic acid, are all converted into bodies soluble in alkalies; they can, therefore, be readily separated from anthraquinone.

Upon these facts Luck founded the following process for determining the purity of anthracene by converting it into anthraquinone:—

One gramme of the anthracene to be tried is to be dissolved by boiling it with 45 cubic centimètres of glacial acetic acid in a small flask. It is filtered, if necessary, while boiling hot, through a small filter, and a solution of 10 grammes of chromic acid, in 5 c.c. water, and 5 c.c. glacial acetic acid, is gradually added in small portions, keeping the liquid boiling gently. This is continued until a greenish-yellow colour appears, or until a drop of the liquid being let fall upon a silver coin, produces, after a few minutes, a reddish spot of chromate of silver. This, of course, indicates the presence of excess of chromic acid, and, therefore, that all impurities have been destroyed.

The liquid is cooled, diluted with 150 c.c. water, and, after a few hours, is filtered. The substance on the filter is anthraquinone, which is washed first with water, then with hot very dilute potash solution, then with water again, and dried at 100° C. = 212° F. The anthraquinone is then removed from the filter, and the latter weighed again. The difference in the weight is that of the anthraquinone.

Dr. Auerbach, writing for professional chemists, did not think it necessary to state that a filter-paper dried must always be weighed in a closed vessel. A very wide glass test-tube, closed with a cork or glass stopper, will serve the purpose; large watch-glasses ground together, and held by a brass clip, are also very convenient. To the weight obtained, 0·01 gramme is added, because that amount remains in the solution.

Commercial chromic acid often contains lead. In this case, the anthraquinone, after the washing with dilute potash solution, must be treated with a hot solution of acetate of ammonia.

In spite of what has been said about the accuracy of this process, it was found in practice that a part of the impurities sometimes escaped oxidation, and were, consequently, estimated as anthraquinone, and the results came out too high. Luck, therefore, improved his method, and, after the treatment of the anthraquinone with alkali, washed it with a washing bottle, into a beaker. The solution, rendered slightly alkaline, was made to boil. A solution of permanganate of potash was then added, drop by drop, until the solution became red. A little oxalic acid and sulphuric acid were then added, to reduce the excess of permanganate, and to dissolve the peroxide of manganese. It was then filtered through the same filter, washed with water until the acid reaction had disappeared, then with very dilute boiling solution of caustic soda, and finally with water. It was then dried at 100° C., and weighed with the precautions above given.

Luck states that although many samples of anthracene require 15 grms. of chromic acid, in general 10 grms. may suffice. Dr. Auerbach remarks upon this, that "this leaving open the amount of chromic acid to be used leads often to very unpleasant results. Thus, *e.g.*, a crude anthracene was oxidized with 10 grms. of chromic acid, and the result obtained in four analyses was each time 26 per cent., whilst the same anthracene, on treatment with 15 grms. of chromic acid, gave in six analyses 23 per cent. of anthracene, and in both cases chromic acid was present in excess. It seems that a slight excess of chromic acid has no longer an oxidizing action upon the anthracene in presence of the acetate of chrome, and that a larger excess of chromic acid completes the reaction."

From what has been said, it is plain that 15 grammes of chromic acid should be used. Luck's process, with the precautions given, is the only method now in use.

Those who wish for a full account of anthracene and anthraquinone are referred to Auerbach's exhaustive treatise previously mentioned. It must, however, be understood that almost all anthracene manufacturers have processes of their own, which differ rather in detail than in principle from those given above.

Communicated Article.

EXPERIMENTS ON GENERATOR FURNACES.

I.

By "Isca."

A Commission appointed by the German Gas and Water Managers Association to investigate the working of gas generator furnaces under variations of draught, has issued a voluminous and exhaustive report, parts of which have from time to time been published *in extenso* in the *Journal für Gasbeleuchtung*. It contains much interesting information gathered from a multitude of experiments, the conditions of which are noted with great care, and the results obtained therefrom are set forth with that painstaking attention to detail which is generally found characterizing German research in other fields of inquiry.

It is obvious that the question of the draught with which these furnaces are worked is one that contains within itself the whole principle upon which their construction is based. A brisk or a slow draught to any fire means all the difference between a large supply of oxygen and the reverse; between the constitution of the effluent gaseous products of combustion under the several conditions.

It is impossible to speak too highly of the labours of the Commission, who seem to have been unremitting in their attention not only to the chemical examination of the gases themselves—frequently making analyses for CO and CO_2 at intervals of 15 minutes—but also recording their observations on the practical working of the furnace, and making impartial comments thereon, which are of importance in explaining or qualifying the theoretical results.

The experiments were carried on at Leipzic, with coke from Zwickau coal, which was sometimes used in its ordinary "through and through" state, and on other recorded occasions was carefully sorted, and only the large coke burnt. Generally speaking, there does not appear to be much advantage in picking the coke, as long as it is clean, and free from foreign substances.

The first experiments were made with the lowest possible draught—in fact, when the fire was started, there was no draught at all, and only the very slight vacuum of 0·004 inch was subsequently allowed. Under these circumstances, the consumption of coke was, of course, very small, and no working result was secured; but the formation of CO was decidedly well marked. The highest observed draught was 0·444 inch, which seems to have been the greatest vacuum attainable by the Commissioners with an open damper, and the consumption of coke rose considerably, but not in anything like the same proportion, for although the draught was increased one hundred times, the consumption only increased rather over four times. Between these extremes many experiments were conducted, under conditions and with results as shown in Tables I., II., and III., which are appended to this article, and which explain themselves. The "slits" mentioned are the openings in the bottom of the generator, for the admission of air; they were, however, removed in some of the experiments,

to make way for a "grate," or fire-bars. These slits were made in specially constructed fire-tiles, but gave much trouble by becoming fused with the clinker, which was also a source of great trouble with the grate or fire-bars, even to the point of interrupting the continuous working of the furnace by preventing the admission of air, until special means were devised for surmounting the difficulty. In fact, the clinker was frequently so hard and thick, that no impression could be made on it with the ordinary clinkering-bars, and if it had not been conquered, the whole system would have been rejected as impracticable in ordinary working.

One of the side issues of these experiments was the question of the permeability to atmospheric air of the brickwork composing the generator furnace itself, which was conclusively proved. It is stated that, the furnace having been repeatedly heated and cooled, the walls were fissured with innumerable cracks. Those most evident were carefully stopped with fire-clay, yet the leakage was very considerable, and its effect in increasing the percentage of CO_2 in the gases had to be allowed for. This is very evident in experiments E and F, which were made with one slit only, the consequence being a reduced consumption of coke, owing to the restricted supply of oxygen *through* the fuel from the bottom, while the infiltration through the walls was as rapid as when the furnace was in full activity.

Returning to the comparison of the slit-generator and the grate-generator, it was noticed that there was less residue with the latter than with the former, chiefly because the slits were of greater width than the spaces between the fire-bars. It was also observed that a great deal of the difficulty experienced in keeping the furnace clear for the passage of the draught through the fuel, was due to the fact that the incandescent coke and dust formed an arch or dome extending over the area of the furnace at some distance above the grate-level; so that although the cinders might appear perfectly loose at that point, the upper portion of the charge would be entirely shut off from any supply of air. The proper breaking up of this dome of ashes and clinkers was a very troublesome duty.

With the object of rendering the clinker brittle or friable, so as to be more easily removed without destroying the cheeks of the furnace, the effect of the admission of steam was next experimented with.

The first circumstance noted was that the temperature of the effluent gases did not appear to be materially affected by the steam admitted to the fire. When no steam was used, the gases at the outlet were found to have a temperature of 1562° Fahr. When steam was introduced under the grate of the furnace at the rate of 620 kilogrammes per 12 hours, the temperature at the same point was 1706° Fahr. It appears, therefore, that the heat lost by radiation and conduction, when working "dry," can be used for decomposing a considerable quantity of steam without lowering the effluent gases to any great extent. In fact, as a result of the experiments subsequently carried out, it was found that steam, when admitted within certain limits as to quantity, becomes truly decomposed, and the oxygen being taken up by the slag and the carbon, the uncombined hydrogen is burnt with good effect.

At an early period of the experiments with steam, the clinker was observed to be affected in a manner which seemed unmistakeably to indicate that it might possibly be softened, and ultimately disintegrated, by that agency, provided that the quantity required should prove to be under the point at which a sensible lowering of the heat of the gases would take place. This important question, holding out, as a consequence of its satisfactory solution, the benefits of regular working, as well as the avoidance of a great amount of arduous labour, was considered worth a special series of experiments, to determine the proportion of steam to coke which would best satisfy the two conditions above mentioned.

TABLE I.—*Comparative Conditions of Experiments.*

Experiment.	Conditions of Experiments.			Consumption of Coke during the Experiment.		Consumption of Coke in 24 Hours.	
	Number of Hours.	Average Pressure in the Gas Channel		Gross Weight.	Residue.	Gross.	Less the Residue.
		Inch.		Kilos.	Per Cent.	Kilos.	Kilos.
A	13	—0·004	Unassorted Coke. 2 slits.	330	13	609	530
B	12¾	—0·063		525	13	988	860
C	15½	—0·043		604	13	935	813
D	22	—0·301	Unassorted Coke. 1 slit.	1500	12·1	1637	1440
E	11	—0·297		580	13	1265	1100
F	24	—0·267		1096	13	1069	930
G	17	—0·173	Coarse Coke. 2 slits.	1203	12·7	1698	1482
H	20	—0·444		2160	12·7	2592	2264
I	16	—0·067		860	13·7	1290	1113

TABLE II.—*Chemical Composition of the Heating Gas.*

Experiment.	Average Pressure in the Gas Channel.	Quantity of		Number of Slits.
		CO_2.	CO.	
	Inch.	Per Cent.	Per Cent.	
A	—0·004	3·6	23·8	Two
C	—0·043	2·7	24·6	Two
B	—0·063	4·8	23·0	Two
I	—0·067	4·5	25·7	Two
G	—0·173	3·8	23·4	Two
F	—0·267	6·6	18·8	One
E	—0·297	9·5	13·5	One
D	—0·301	6·9	21·5	Two
H	—0·444	5·9	17·9	Two

TABLE III.—*Consumption of Coke and Quantity of Residue during the Period of Twenty-four Hours, in the Slit-Generator Furnace.*

Consumption of Coke.	Total Residue.		Composition of the Residue.						Quantity of Gasified Coke, less Residue.
			Coke.		Ashes.		Clinker.		
Kilos.	Kilos.	Per Cent.	Kilos.	Per Cent.	Kilos.	In Per Cent. of gasified Coke.	Kilos.	In Per Cent. of gasified Coke.	Kilos.
1,380	82	5·94	7	0·51	26	1·88	49	3·55	1,292
1,025	175	17·07	8	0·78	68	6·63	99	9·66	850
912	203	22·26	6	0·66	73	8	124	13·60	709
1,534	185	12·06	4	0·26	68	4·43	113	7·37	1,349
1,400	162	11·57	4	0·29	65	4·64	93	6·64	1,238
1,384	176	12·70	13	0·92	76	5·50	87	6·30	1,208
2,203	280	12·70	20	0·92	121	5·50	139	6·30	1,923
1,905	262	13·75	36	1·91	141	7·41	85	4·43	1,649
350	48	13·75	7	1·91	26	7·41	15	4·43	302
12,093	1573	13·01	105	0·87	664	5·49	804	6·65	10,520

Correspondence.

[*We do not hold ourselves responsible for the opinions expressed by Correspondents.*]

CALCULATING "FEET OF SURFACE" IN CONDENSERS.

SIR,—Would it not be an advantage if engineers would reckon in cubic feet, instead of "feet of surface," for condensation calculations?

Take, as illustration, the arrangement by Mr. Croll for the City of London Gas-Works, where 1152 feet of 18-inch pipe give 5472 feet of surface, or 2040 cubic feet. Now, had he taken 24-inch pipe, 864 feet would not only have given the same feet of surface, but also 2720 cubic feet, or one-third more than the 18-inch pipe contained; or, had he used 12-inch pipe, 1728 feet would have been required for the same feet of surface, but the cubical contents would only have been 1360 feet.

It would seem, therefore, that cubic feet should be the basis for calculations. For three equal works using the same quantity of feet of surface as above would widely differ in cubical results—one having 1360 feet, the second, 2040, and the third, 2720; and, consequently, the results of condensation would greatly vary.

Perhaps some one will kindly give the reason for the present system of calculation.

W. C. BENNETT.

Tiverton, April 25, 1879.

Parliamentary Intelligence.

HOUSE OF LORDS.

MONDAY, APRIL 21.

The Examiners reported that no further Standing Orders are applicable to the following Bills:—Glossop Gas, Manchester Corporation Water, Tipton Local Board, Brighton and Hove Gas.

Pemberton Local Board Bill, Sleaford Water Bill,—brought from the Commons, read the first time, and referred to the Examiners.

New River Company Bill, Nottingham Water Bill,—read a second time and committed.

Petitions against the following Bills were presented:—Brighton and Hove Gas, from (1) Corporation of Brighton, (2) Hove Commissioners, (3) Amelia Smith; Glossop Gas, from Corporation of Glossop; Manchester Corporation Water, from (1) Richard Henry Ainsworth, (2) John James Spedding and others.

Manchester Corporation Water Bill.—Petitions praying to be heard against alteration in this Bill were presented from (1) Corporation of Oldham, (2) Water Joint Committee of the Leigh and Hindley Local Boards.

TUESDAY, APRIL 22.

Grand Junction Water Bill, Bury St. Edmund's Gas Bill,—reported without amendment.

Glasgow Corporation Water Bill, Portsmouth Water Bill, Rawmarsh Local Board Bill,—brought from the Commons, read the first time, and referred to the Examiners.

The Colwyn Bay Water Bill was read the third time, passed, and sent to the Commons.

Metropolitan Sewage.—A petition for the prevention of the pollution of the Thames by London sewage, was presented from the Vestry of Plumstead.

RIVERS CONSERVANCY BILL.

On the motion for going into Committee on this Bill,

The Earl of REDESDALE said that the Bill as it stood embodied the extraordinary proposition that persons were to be taxed for the improvements effected on the property of others. The Bill gave power for the compulsory removal of impediments in the channels of rivers, but where such improvements had been legally erected, compensation was to be paid for their removal. The proprietors of the upper lands were not, however, to be so dealt with. It was assumed that the underland drainage carried on by them had had the effect of flooding lowlands, and they were to be taxed under the Bill for having done that which they were legally entitled to do. He begged to move this resolution—"That if A having ten years ago purchased a property in the uplands of a river conservancy district, in the valuation of which the liability to a charge for a conservancy rate could not have been included, and B having in the same year purchased a property in the flood lands of the same district, in the valuation of which the damage from floods must have been necessarily estimated, it will be unreasonable and unjust that A's property should be taxed for the improvement of B's property, when his lands cannot receive any benefit from the outlay to which, under the Rivers Conservancy Bill, he is to be compelled to contribute."

Lord SANDWICH thought there could be no doubt that the flooding of the lowlands resulted from the excessive drainage of the upper lands, and he was of opinion, therefore, that the proposition to tax the proprietors of the latter class of lands was a just one.

The Earl of KIMBERLEY felt considerable hesitation in opposing any proposition which came before their lordships with the high recommendation which was in favour of the proposition to tax the proprietors of the highlands. He was aware that, with the exception of Mr. Rawlinson, all the Engineers who had been examined before the Committee of their lordships House were of opinion that the drainage of the upper lands had

caused the lowlands to be flooded. Notwithstanding the high authority for that proposition, he begged to dissent from it. This Bill went too far in the way of taxation, and a moment like the present, when there was such distress in the agricultural districts, was an awkward one for promoting such a measure.

The Marquis of HUNTLY objected to the resolution of the noble earl, the Chairman of Committees.

The Duke of RICHMOND and GORDON said that the Government had brought in this Bill after they had been pressed over and over again to take action on the report of the Select Committee. He had put on the paper, amendments which would give occupiers a larger share of representation on the Conservancy Boards than they would have under the Bill in its present shape; but he could not consent to the general proposition which his noble friend the Chairman of Committees wanted to establish. His noble friend's resolution was an abstract one, and would in no way change the Bill; but the proposition seemed to be that an owner of property should not be taxed for anything which did not entail taxation when he became possessed of his property. The evidence taken by the Select Committee showed that the increased drainage of the upper lands brought down an amount of silt and stuff to the channel of the river in its course through the lowlands, and for that reason it was thought but just that the proprietors of the upper lands should be taxed under the Bill.

The Duke of SOMERSET said that under the Bill there would practically be no inquiry, and no appeal to Parliament. The Act was to be carried out by Provisional Orders, and there was to be a new area of taxation. Any one who had a complaint must go to the Local Government Board. The system of Provisional Orders required close watching.

The Marquis of RIPON did not concur in what his noble friend said about Provisional Orders. The weight of evidence, professional and practical, was against the contention of his noble friend (the Earl of Kimberley), and went to show that the drainage of the upper lands did increase the flooding of the lowlands.

The Earl of REDESDALE withdrew his resolution.

Their lordships then went into Committee on the Bill, and clauses up to No. 3 inclusive were agreed to.

On clause 4,

The Marquis of RIPON moved an amendment, the effect of which was to provide that, where necessary, the conservancy districts might be divided into sub-districts.

On clause 5,

The Duke of MANCHESTER, who contended that underground drainage on upper lands did not bring down silt, moved as an amendment the insertion of the words "according to the benefit to be derived." This was by way of instruction to the Local Government Board in setting up a Conservancy Board?

The Duke of RICHMOND and GORDON asked how was "the benefit to be derived" to be ascertained by the Local Government Board, when setting up a Conservancy Board.

The Duke of MANCHESTER said he did not care to press this amendment.

The Earl of KIMBERLEY was surprised that the noble duke was so ready to abandon his amendment. The principle of the Bill was that some benefit was to be derived by those who were to be taxed. The Lord President said the Local Government Board could not know the benefit to be derived in any particular case, and so could not assess it. The amendment laid down the only sound principle upon which the Local Government Board could act.

The Duke of RICHMOND and GORDON said the Local Government Board were to set up a Conservancy Board, but it was impossible that the Board could beforehand declare what would be the benefit to be derived by the persons who were to be rated.

The Marquis of RIPON said that the Act of Henry VIII. laid down that only those lands were to be taxed that derived direct benefit—that was to say, the lowlands. That was the meaning of the amendment, which raised the whole question whether uplands were to be taxed or not.

Lord SELBORNE said that as he read the Bill the question involved was to be determined, in the first instance, by the Local Government Board.

The Duke of RICHMOND and GORDON said they were to do so by means of a Provisional Order; but the Local Government Board could not determine the character of the benefit to be derived before a Conservancy Board had been set up.

The Earl of CAMPERDOWN said the Bill appeared to place upon the Local Government Board the duty of defining the lands which were to be deemed flood lands, intermediate lands, and uplands, for the purposes of the Order. In what part of the Bill was any principle laid down on which the Local Government Board were to act?

The Duke of MANCHESTER said the Board would have to apportion the area to the three different classes of land, and he desired to suggest the principle on which the proportions should be determined.

The Committee divided on the question that the words "according to the benefit to be derived" should be inserted, and the numbers were—

Contents	20
Not contents	42
Majority	—22

The amendment was therefore negatived.

The Duke of MANCHESTER moved his next amendment to omit the words "and uplands," for the purpose of inserting "flood lands."

The Committee divided on the question that the words "and uplands" stand part of the Bill, and the numbers were—

Contents	41
Not contents	19
Majority	—22

The amendment was therefore negatived.

The Marquis of HUNTLY moved a rider to the clause, by which it was understood that the Sanitary Authority should contribute a certain proportion of the gross sum required for the works to be undertaken.

The Duke of RICHMOND and GORDON could not accept the amendment. It would be impossible to say what would be the gross sum of the works undertaken by the Conservancy Board.

The amendment was withdrawn, and the clause was agreed to.

In clause 6, line 28,

Earl COWPER proposed to leave out the words "life members and." The effect would be to do away with "life members."

The Duke of RICHMOND and GORDON thought it of great importance to secure the permanency of some members of the Board, as had always been done in the Commission of Sewers.

After some verbal amendments, the clause was agreed to.

Clause 7 was then agreed to, as were also the remaining clauses of the Bill, with some verbal amendments, and the House resumed.

THURSDAY, APRIL 24.

Nottingham Water Bill, New River Company Bill,—reported without amendment.

The Examiners reported that the further Standing Orders applicable to the Westgate and Birchington Water Bill had been complied with.

Bills read a second time, and committed:—Brighton and Hove Gas, Manchester Corporation Water, Tipton Local Board.

FRIDAY, APRIL 25.

The Examiners reported that the further Standing Orders applicable to the Sleaford Water Bill had been complied with, and that no further Standing Orders were applicable in the case of the Pemberton Local Board Bill.

Glossop Gas Bill,—read a second time, and committed.

Grand Junction Water Bill,—read the third time, and passed.

HOUSE OF COMMONS.

MONDAY, APRIL 21.

Bills read the third time, and passed:—Glasgow Corporation Water, Portsmouth Water, Rawmarsh Local Board.

A petition in favour of the East Retford Water Bill was presented from Inhabitants, &c., of East Retford.

A requisition to withdraw their petition against the Arlecdon and Frizington Water Bill was presented from the London and North-Western and Furness Railway Companies.

TUESDAY, APRIL 22.

The East Retford Water Bill was reported.

The Birmingham Corporation Water Bill, as amended, was considered; to be read the third time.

London Gaslight Company, West Kent Main Sewerage Bills,—read a second time, and committed.

Knutsford Light and Water Bill.—The Examiners report, that the Standing Orders had not been complied with in the case of the petition for additional provision in this Bill, was referred to the Select Committee on Standing Orders.

Cardiff Corporation Bill.—Requisitions to withdraw their petitions against this Bill were presented from (1) Lord Windsor, (2) Lessees and occupiers and water consumers in Penarth.

THE GASLIGHT AND COKE COMPANY BILL.

On the motion of Sir CHARLES FORSTER, the order that this Bill be committed was read and discharged, and the Bill withdrawn.

WEDNESDAY, APRIL 23.

A requisition to withdraw his petition against the Weardale and Shildon District Water Bill was presented from George Jederton Leaton-Blenkinsopp.

THURSDAY, APRIL 24.

Birmingham Gas Bill read the third time, verbal amendments made, and Bill passed.

A requisition to withdraw his petition against the Blackburn Improvement Bill was presented from the Postmaster-General.

FRIDAY, APRIL 25.

The Examiners reported that no Standing Orders not previously inquired into were applicable in the case of the Dun Drainage Bill.

Birmingham Corporation Water Bill,—read the third time, and passed.

Lancaster Gas Bill, Warrington Corporation Bill,—read a second time, and committed.

Bromley Gas Bill, Southend Water Bill,—as amended, considered; to be read the third time.

Bills reported:—Cardiff Corporation, Belfast Water.

Lords Bill reported with amendments:—Llandudno Improvement.

The Colwyn Bay Water Bill was brought from the Lords, read the first time, and referred to the Examiners.

Requisitions to withdraw their petitions against the following Bills were presented:—Blackburn Improvement, from Edward Petre; Nottingham Corporation, from the Postmaster-General.

SATURDAY, APRIL 26.

Requisitions to withdraw their petitions against the Aire and Calder Navigation Bill were presented from (1) Lancashire and Yorkshire Railway Company, (2) North Eastern Railway Company; and against the Nottingham Corporation Bill, from Great Northern Railway Company.

HOUSE OF COMMONS COMMITTEE.

FRIDAY, MARCH 21.

(*Before Mr.* WYNN, *Chairman; Mr.* WALTER JAMES, *Mr.* CORTAULD, *and Colonel* WINDSOR-CLIVE.)

GLOSSOP GAS BILL.

Mr. RICHARDS, Q.C., and Mr. MICHAEL, Q.C., appeared for the promoters; and Mr. ASPINALL and Mr. SHIRESS WILL for the Corporation of Glossop, petitioners against the Bill.

Mr. RICHARDS, in opening the case, said that when the Company was originally incorporated, their capital was limited to £6000. The present case was an extremely simple one, as the Company merely sought for powers to raise further capital and to acquire additional land. Prior to 1845, there was no gas company in Glossop; but in that year a company was formed, which started with a capital of £6000, with power of increase to £10,000, either by way of fresh capital, or by means of mortgage. The dividend was limited to 10 per cent. as a maximum; the reserve-fund was £1000; and the district was the whole township of Glossop. The Gas-Works Clauses Act was passed in 1847, but the private Acts previously passed contained nearly all the clauses consolidated in that Act. In the session of 1855 another Act was obtained, increasing the capital to £18,000, when the price of gas was limited to 6s. per 1000; the Act of 1845 having contained no such limitation. The whole of the capital authorized by the Act of 1845 had been raised, except £1800. The Company had been, upon the whole, very successful, except during the period of the cotton famine, from 1862 to 1865. Prior to that period the Company had been enabled to pay their full dividend, but during those four years they were unable to do so, although success had subsequently returned, and arrears to the amount of £2075 had been paid off. They had not divided the sum which Parliament contemplated they would do by £3400. During the whole of that depressed period the Company had never charged the maximum price allowed by their Act, but 5s. 2d., less 5d. per 1000 discount on all accounts paid within a month. That fact should be taken into account; for, if the Directors had charged the full maximum to which they were entitled, they would have been able to come before the Committee with the statement that they had paid to the Shareholders the last penny to which they were entitled. Instead of that, however, they had given to the inhabitants of Glossop, in whose welfare they doubtless felt considerable interest, the advantage of cheaper gas. The limits of the new district originally included the whole of the townships of Hollingworth and Tintwistle; but, considerable objection having been raised on the part of certain persons, the proposed extension was abandoned, except in so far as regarded the portions of the hamlets which were thrown into the borough by the diverse course of the River Etherow. The Company were now seeking to raise £40,000 additional capital, and asking for loan powers

to the extent of £10,000. Auction clauses were also introduced into the Bill, but those he did not in any way seek to defend. The illuminating power proposed was 14 candles, which was the ordinary standard throughout England. With reference to a petition which had been presented by the Corporation of Glossop, alleging, amongst other things, that the existing capital of the Company was amply sufficient to meet all their present requirements, that, of course, would be a question of evidence; but what earthly object could the Corporation have in thus obstructing the progress of the Gas Company, and causing them a tax of 20 per cent. for parliamentary costs? The petitioners sought to have the price reduced to 3s. 6d. per 1000, which would be a third lower than the standard of The Gaslight and Coke Company. That was an ungrateful return for the leniency of the Company; but, to quote an expression of Lord Thurlow's, "gratitude was not to be expected from a corporation."

Mr. ASPINALL said that, with regard to sub-section 7, all his clients meant was that they desired to have the provisions of the Public Health Act extended, so as to enable them to purchase by agreement, the difficulty being at present that the district extended a little beyond the borough.

Mr. MICHAEL said there was not the slightest difficulty. What his friend really meant was that, under certain circumstances, without coming to Parliament at all, the Local Government Board should have the power to grant the money required to carry out the agreement under the Public Health Act of 1875, which enabled an Urban Sanitary Authority to purchase by agreement the property of the Gas Company.

Mr. ASPINALL: That is only where it is within the district.

The CHAIRMAN: Do you say the Local Government Board have the power to purchase?

Mr. MICHAEL: No. The Local Board—the Urban Sanitary Authority—have power to purchase; but it is necessary, before any works can be constructed and paid for by an Urban Sanitary Authority, under the head of what are technically called permanent works, that there should be permission granted by the Local Government Board to borrow the money that is necessary for carrying out either the works or the purchase. The Local Government Board have held, with respect to gas, that when a gas company supplies beyond the limits of the urban sanitary authority, they must apply for an Act of Parliament to carry out the necessary powers, and not merely to borrow money under the Public Health Act of 1875. As the matter stands at present, our supply, I believe, is coterminous with the district of the Glossop Urban Sanitary Authority. If the small portion is added which is between our present borough limits and the river, then we shall be a little beyond; but, under any circumstances, my friend would really have to apply to Parliament for power. Since the Public Health Act of 1875 was passed, an urban sanitary authority purchasing is obliged to come to Parliament, in order to obtain the necessary power to carry on their undertaking. We have found that a Provisional Order is not sufficient, and therefore practically it comes to exactly the same thing.

Mr. ASPINALL: I am afraid you are not quite accurate as to the facts. As a matter of fact, you go a little beyond the river.

Mr. MICHAEL: I think you are right as to that. I believe the old township is a little larger.

The following evidence was then called:—

Mr. *S. Robinson*, examined by Mr. NORTON (Agent for the Bill).

I have resided at Glossop for about 35 years. I have been a Shareholder in the Glossop Gas Company since 1848, and Chairman of the Company since 1860. I remember what is called the cotton famine, which prevented the Company paying their dividends. It was a frequent subject of discussion during the cotton famine, whether or not they should raise the price of gas to the maximum; but they did not do so, as they preferred to keep the price down, in order to give the public the benefit of it. The Company's dividends were in arrear during the years 1862, 1863, 1864, and 1865; the total amount up to 1865 being £5478, of which the sum of £2075 has since been paid off, leaving £3403 unpaid. Up to 1866 the Directors acted gratuitously, but since then they have been remunerated, the total amount paid to them being about £150. The district that the Company supplies with gas is a very straggling one, and there are some very large consumers who manufacture their own gas. Before making the present application to Parliament, the Company had been looking out for a good site for the erection of additional works, and the spot selected is thought to be a good one. The capital of the Company under the Act of 1855 was £18,000, and £10,000 previously. Out of that £18,000 there is a small sum not yet called up, amounting to £1800.

Cross-examined by Mr. ASPINALL: There is a main street; but our principal district is a long way from the works. I remember being asked to light the new road from Glossop to Hadfield, but refused to do so, for the reason that there were no sources of profit. The population of Glossop is between 17,000 and 18,000. There are a considerable number of houses not lighted by the Gas Company. A number of persons grumble at the price, but I have not heard much about the quality. At a public meeting held in 1874 or 1875, the following resolution was passed:—"That, in the opinion of this meeting, the Glossop Gas Company do not afford to the inhabitants of the borough a supply of gas of such illuminating power as is necessary for domestic comfort for the working classes, and for the proper illumination of the streets, and that such supply as is afforded is of an inferior quality and sold at an excessive price." I did not reply to the resolution, and cannot say if it was carried unanimously. A meeting of the ratepayers was called a few days ago, under the Borough Funds Act, to authorize opposition to this Bill. The ratepayers sanctioned the opposition, but there were three or four gentlemen who objected to it. I demanded a poll, the result of which was that 2475 voted in favour of opposition, and 163 against. We have no ground at present uncovered by works, except a yard which is used for stores. Our ground is limited, and to make any addition would be impossible.

Mr. *C. Greaves* (examined by Mr. NORTON), said he had been a Director of the Gas Company for seven years, and corroborated the evidence given by the former witness.

In cross-examination by Mr. ASPINALL, witness said he was not aware that the large manufacturers had ever applied to the Company for a supply of gas—although the latter would be very glad to treat with them—because they knew that they could make their gas cheaper than the Company could supply them with it. If the price of gas had been raised during the cotton famine, no doubt it would have diminished the consumption.

In reply to the COMMITTEE, witness said that Lord Howard of Glossop refused to allow the Company to have any more land at the present works. He resided about a quarter of a mile from the place, and said they were not agreeable customers at any time, and he should not like any additional smell to be near his residence, as he had sufficient of it at present. A deputation waited upon him, and asked for a small extension of land, and at first the steward stated that perhaps the Company might have it at rather an exorbitant price—something like 50 per cent. more than they were paying for cottage property close by; but his lordship subsequently declined to let them have it, even to the extent of erecting another gasholder.

Mr. *James Dalgliesh*, examined by Mr. MICHAEL.

I am Engineer and Manager of the Glossop Gas-Works, having been appointed in 1876. I was previously connected with the Ashton Company for 11½ years. No. 1 plot of land contains 3790 square yards, and the buildings are erected upon it—Office, governor-house, coal and cannel sheds, condensers, a small retort-house, with 25 single 9-feet retorts, capable of producing 100,000 feet of gas per diem; a steam-boiler, engine, exhauster-house, lime and purifying houses, meter-house, store-rooms, workshops, and board-room; one 30-feet gasholder, now unworkable; one 60-feet gasholder in use, with all necessary appliances, and storeage room in the yard for coke, &c. There are three other plots, the whole area containing 7912 square yards. Our production of gas during last year was 38,754,600 cubic feet. Our maximum daily production was on Dec. 20 last. 242,000 cubic feet; and our minimum, 47,000, on June 21. The capacity of our present gasholder is 230,000 feet workable. In 1869 the production was 26,855,000 feet, and in 1878 it had reached 38,754,600. From 1868 to 1878 the increase was 54 per cent.; that is compound ratio, the simple being about 5½ to 6. In 1869 we sold 20,320,676 feet, charging 5s. per 1000 net, which produced £4423 6s. 2d.; and in 1878, 29,899,638 feet, at 4s. 9d. net, producing £6625 16s. 3d. That 4s. 9d. was subject to discount.

By the COMMITTEE: The net average of the whole ten years, from 1868 to 1878, was 4s. 4·18d. The discount upon immediate payment was from the 5s. 2d.

Examination resumed: The average price charged last year to the Corporation for the public lamps was 4s. 0·8d. per 1000, or £1 2s. 2d. per lamp; that is the entire consumption. I cannot say how many hours the lamps burn; they do not furnish us with a list at the time, so that we go by the average meter system. In the borough of Glossop we have one meter to every 16 lamps, and on the Hadfield side, which is a new district, there is one to every eight. In Dec., 1878, we had 2126 house and shop consumers, and 27 firms of workshops and manufactories, 139 of this number being in Tintwistle, which is outside our district. Tintwistle is now struck out of the Bill. The total amount of our capital now expended is £32,442 17s. 11d, which works out to £832 per million feet, and it is a very fair average; I know there are many over £1000 per million. There are 344 public lamps in the borough. The total amount of gas consumed by the Corporation in 1878 was 1,931,362, at an average price of 4s. 1·8d. per 1000. A good number of the large firms manufacture their own gas.

By the COMMITTEE: I cannot give you the exact cost of gas, putting out of the question the interest and plant, to a private consumer making his own gas at Glossop, but I know that one member of the firm of Sumner gave me to understand that they did not know their exact cost of production, and he was under the impression that we could supply them at a cheaper rate than they could make it themselves, only they have their present plant, and they make use of it. I have no idea how the private firms at Glossop conduct their works, and therefore do not know what the cost of their production will be.

Examination resumed: They do not weigh their coals, and have no idea of the actual quantity carbonized. I believe we could supply them with gas cheaper than they can make it; but then they have the plant already existing, which, of course, they would lose.

By the COMMITTEE: I believe that a firm in Glossop making its own gas could supply itself at 3s. or 3s. 6d. per 1000. We now supply large consumers at as low as 3s. 7d., which is our minimum.

Examination resumed: Of course, the manufacturer has only to look at the cost, without taking into account the interest upon the capital expended, and he has no expense for distribution, while we have those two items to add.

The CHAIRMAN: The witness says he goes down to 3s. 7d. Mr. Robson said the present price, if paid within a month, was 4s. 9d., so that there is a considerable difference.

Examination resumed: There are two firms supplied at 3s. 7d., but they take a very large quantity, and therefore it is much cheaper to supply them than to distribute it to a great number of small consumers. The number of houses to which we supplied gas in Glossop last year was 2126; but we have something like 1142 houses in Glossop and Tintwistle not consuming gas, which I attribute to the wretched fittings in the town. A number of houses had been fitted for gas, but, owing to the bad state of the fittings, the parties gave up the supply rather than pay the expense of their repairs. If the price were reduced, as asked for by the Corporation, it would prove a positive loss on the working. Supposing the price of coal prevailed at the present time as in 1873, there would be a loss of £1644 13s. 5d. on the year's working; and if the price of coal and cannel were the same as in 1873, and the price of gas were taken at the same as in 1878, the loss then would be £252 1s. 4d. If we take the present price of coals, and the 3s. 6d. which is asked for by the Corporation as the price of the gas, there would be a profit of £1306 8s. 1d., which would only pay a dividend of 4 per cent. on the present capital of £30,600.

Cross-examined by Mr. ASPINALL: If the 1142 houses not using gas were supplied, there would be an increase of about £500 a year in the profits of the Company. The fittings are now done by authorized persons, but, previous to my time, tinmen used to do the work, and it was all quarter-inch work. The price of gas at Ashton is 3s. 5d., I believe; it is cheaper than at Glossop, because the town is more compact, and the consumption per mile much greater. At Glossop we have 29·59 miles of mains. When we go beyond 12 feet from the main on private property we charge for the extra distance.

By the COMMITTEE: The average price of our coal last year was 12s. 11·46d.; but it is cheaper at Ashton, as that town is nearer the collieries.

Cross-examination continued: The price of gas at Oldham, I believe, is 3s. 4d.; at Dukinfield, 3s. 9d.; at Hyde, 4s. 2d.; Stalybridge I do not know, nor Stockport. At Ashton, 16 candles is the illuminating power. No more gas could conveniently be made on the present site. We have a 30-feet holder which is considered totally unfit for use in the present day. The extended district which we originally contemplated was one of our reasons for asking for the new site. Though we have given up the extended district, we still ask for the new site, as we could work at a much lower pressure. The retort-house is only half occupied with retorts, but we have also to use it for the storeage of coal. We could double the storeage capacity for gas by telescoping the present holders, but we consider that plan to be objectionable. Telescopic holders are nearly universal, but they are objectionable in the Glossop district, as we are subject to very high winds occasionally. When these prevail, the pulleys sometimes snap, and cause us great anxiety until they are replaced by stronger ones. There is also a little engineering difficulty in regard to our inlet and outlet connections. If the 14-candle standard were adopted, we should have to supply nearly 16, to keep within the meaning of the Act. We are introducing Sugg's burner by this Bill. I do not think the effect of that would be to reduce the illuminating power we should have to give.

Mr. ASPINALL: Then why was it inserted? You changed it from the old burner?

Mr. MICHAEL said that originally no illuminating power was mentioned in the Bill, but Lord Redesdale insisted upon it.

Cross-examination resumed: The initial price should not be less than 4s. 6d. in connection with the sliding scale. In Ashton it is 3s. 8d.; but the

consumption there is four times what it is in Glossop. In a straggling district, and there is a liability to leakage. We publish accounts for the Shareholders, but we make no deposit of them for the benefit of the public. The leakage last year was heavy, on account of the severe winter. It was 21·3 per cent., and I account for it by the heavy pressure we have to maintain—a constant day and night pressure of 12·10ths. The leakage at Ashton is about 12½ per cent. At Dukinfield this year it is 29, owing largely, no doubt, to bad mains. There are probably one or two bad mains at Glossop.

Re-examined: It is a very heavy drain on a company to have to keep up such a high pressure during the day. Very few companies maintain more than 4-10ths in the daytime. It is my constant endeavour to reduce the amount of unaccounted-for gas. Hitherto we have been under no restrictions as to illuminating power, and, therefore, for the first time, the public will have the advantage of being able to test our gas. Before we could make 16-candle gas we should be obliged to mix cannel with the coal, which would entail a heavy expense upon us. As our district is a straggling one, the cost of supplying gas is, of course, more expensive.

Mr. *D. Clarke*, examined by Mr. MICHAEL.

I have been engaged about 25 or 26 years in gas-making, and was Manager of the Glossop Gas-Works from 1870 to 1876. The maps produced represent the site of the present works, and also the proposed site of the new works. There are 21½ miles of main. I am now Engineer and Manager of the Ashton Gas-Works, and previous to going to Glossop was Assistant Manager at the Oldham Gas Company's works for about 14 years. At Glossop I endeavoured to supply as good gas as possible. It is, of course, impossible for a gas company, in the extension of their undertaking, to put it up in bits; at certain times they are obliged to expend a considerable amount of capital, and Glossop is no exception to the ordinary rule. As to the capacity of gas-works, with reference to its largest daily supply, taking the manufacturing part, of course, we ought to be able to produce the maximum consumption, and have a reserve of 15 or 20 per cent., and the storeage room ought to be equal to the maximum delivery. It is a little below the average requirement at Glossop. I think it desirable that the Company should have power to erect works upon the piece of land now proposed, and believe it would be for the interest of the gas consumers in Glossop. I do not think that a lower maximum than 5s. 6d. should be inserted in the Bill. I was at Glossop during the cotton famine, and the average price of coal then was 24s. The price is now 12s. 11d.

By the COMMITTEE: That is the average price of coal and cannel together.

Examination resumed: If the price of coal increased, and the price of gas was limited to 5s. 6d., it would take the Company all their time to pay a dividend, but the price suggested in the petition, 3s. 6d., is beyond all reason. It does not follow that the maximum is to be charged. The Company are now charging 3d. per 1000 less than during my management. At Ashton we have a scale of prices, our minimum charge being 2s. 11d., and our maximum 3s. 5d. We are much more favourably situated at Ashton than at Glossop. Our capital per 1000 feet sold is about one-half the amount. We have been under the auction clauses since 1847, and consequently our share capital is something like £20,000 less than the capital invested in works that do not bear dividend; so that we have not the same amount of capital to pay dividend upon as they have at Glossop. The consumption, as regards the proportion of mains, is considerably more in Ashton than it is in Glossop. The whole of the sum which has been derived from premiums has been put into capital, without receiving any dividend, and, therefore, tends to diminish the amount of capital paying dividend on every million feet of gas produced. That is a very important item in calculating the amount of profit required. The total quantity of gas we sell in a year at Ashton is about 128 million cubic feet, over a comparatively thickly-populated area. All these circumstances very materially influence the price of gas. If we have a long line of main, we cannot supply gas so cheaply as where we have a dense population on the same area. We have great facilities for getting cannel coal at Ashton, having it in the district. The 14-candle illuminating power asked for in the Bill is a fair one, and it is, in fact, about the universal illuminating power all through the country—particularly in provincial towns.

The CHAIRMAN: I do not think you need labour that point; it is very well known that that is so.

Examination resumed: The sliding scale, of course, depends upon the initial rate at which you start. With regard to the 1140 houses which are stated to be without any supply of gas, that is very easily explained, as far as my experience in the matter goes. Any one knowing the district, and knowing the character of the parties with whom they have to deal, will not hesitate for a moment to say that, although it is a large amount, it is not excessive. The reasons are, that during the cotton famine there were a large number of people who ran up gas bills which they naturally could not pay, and the Company did not feel inclined to continue the supply unless they could get the money; consequently they stopped the gas. There are very many people, also, who are fond of growing plants in their houses, and they naturally say that the gas injures them. I believe that is a true reason, because it makes the air too dry for them. Another serious matter is that the fittings are certainly in a very bad condition indeed. At one time, we used to fit the houses up partly by contract, and the result can be judged. I am given to understand that the houses are well fitted up for 10s. each, so that the Committee can judge of the competition they had to deal with, and the fittings that were put in. There is no wonder that many tenants complain. The service-pipe now produced is a fair representation of the fittings. I never saw such fittings anywhere else but in Glossop. It is a mere cock to screw on the service-pipe and connect with the meter. In many cases there will be, perhaps, a dozen or fourteen lights supplied from a cock like that. Of course, instead of putting a cock on to cost an ordinary cottager about 2s. 6d., it would cost about 8d.; and the fittings generally are of a similar character.

Cross-examined by Mr. ASPINALL: These fittings are in houses supplied by the Company, and the existence of fittings like those does not prevent the supply, but there is a leakage. I have no doubt it is owing to this fact that the inhabitants refuse to take the gas. They do not carry out this style of fittings now; I stopped it. But I have no doubt there are now many houses in the same condition, although I have not been there for three years. We could not refuse to supply a house because it had bad fittings, but the people refused to take the gas in consequence of the character of the fittings. Out of the number of houses in Glossop, 1142 is a large proportion to refuse a gas supply; but, knowing the district so well, I do not think it so excessive as it appears. The population is a labouring one, who do not change their residences very frequently. Some people who take gas have flowers in their windows; they do not give up gas because of the flowers. The new site is wanted for erecting gas-works for the supply of the district generally. I am not in a position to say that the intended additional district had nothing to do with it, but I do not think the same extent of new works is wanted for the district as now proposed, as would have been wanted for the whole extension which was originally proposed. When I went to Glossop the works were not in a very satisfactory state. I do not know that a great deal more capital has been expended than was necessary for the works; it was about proportionate to what it is now, I think. The Manager before me was Mr. Tomlinson, a servant of Lord Howard's, who, at one time, for a little extra consideration, managed the gas-works; but he was the exclusive servant of the Company for a number of years. I do not say that more money than was really necessary was laid out upon the gas-works; it was a good average. I may say that the capital was rather high, but not excessive.

Mr. ASPINALL: That much from you is quite enough for me.

Re-examined by Mr. MICHAEL: The amount expended is not excessive, taking into consideration the district. I do not think any improper burden is put upon the consumer by the works already existing, and decidedly think it would be advantageous to the consumers for these works to be carried out. It will tend to produce cheaper and better gas, and therefore reduce the price. The Company cannot divide any more than the statutory dividend, and are then bound to reduce the price of the gas.

Mr. *G. W. Stevenson*, examined by Mr. MICHAEL.

I have not been down to Glossop specially for this Bill, but I think my experience enables me to give the Committee information upon the various points suggested, and to which their attention is to be directed. I have looked into the question of the amount of capital for every million feet of gas sold, and in my experience it is not excessive, looking at the character of the works, although it is rather higher than the average throughout the kingdom. I think, if the Company have power to construct the works which are proposed by the Bill, it will be an advantage to the Company and to the Consumers; they must have more land, as they cannot carry on their business without it. It is common in small works to have the coal stores and the retort-house combined. One-half of the retort-house is usually filled with retorts, and the other half is used for coal storeage, until the necessities of the district demand that the whole house should be filled with retorts, and then a coal store has to be erected, but in this case there is no land for the purpose. I therefore think it very desirable that the Company should have this new site. I have not viewed this land specially with reference to this subject, but know the district generally. There is a railway running alongside the land, with an embankment 12 feet high, which will enable them to get coals in very cheaply, and that alone will reduce the cost 2d. or 2½d. per 1000. It would therefore be advantageous, because the Gas-Works Clauses Act will enforce the reduction in the price of gas when the maximum dividend has been earned, and the auction clauses will ensure that the capital is not improperly and unduly expended, as there is absolutely no inducement to a company who raise their capital at public auction to call up that capital unnecessarily. No injury can possibly accrue to the gas consumers from £40,000 being granted; if it was £100,000 it would be the same. The only effect would be that the Company would be saved from coming under the revision of Parliament so speedily as they otherwise would. I have often said that, with the operation of the Gas-Works Clauses Act, a maximum price is altogether unnecessary; because when the maximum dividend has been earned the price must be reduced. The cost price of gas at the consumers burner at the present moment is 4s. 7d. per 1000 feet, but there is nothing included in that for creating a reserve-fund, or for an insurance-fund, or laying by anything whatever; and there should be something. There ought to be a considerable margin to provide for an increase in the cost of coal and of labour, those items at present being at their lowest. The sliding scale is for the benefit of the proprietors, and was obtained by the companies as a set-off against the auction clauses. No conclusion can be drawn as to the selling price of gas without knowing all the circumstances of each individual case, and all the cases previously quoted are two or three times larger than Glossop. At Ashton the cannel is carted into their works, they having three pits within a mile distant. I was concerned for the Ashton Company the session before last, and I advised that the price of 3s. 8d. was a proper standard price, and it was inserted in their Act. The capital in this case is somewhat larger than in Ashton, therefore it requires a larger amount per 1000 feet with which to pay dividend. Ashton was the first company upon whom the auction clauses were imposed, and I think they assumed them voluntarily. The tendency of the introduction of the auction clauses must be to reduce the price. Looking at the price charged for the public lights here, I think that the Glossop Company are dealing very fairly with the public authority. The public lights ought not to be supplied at a less price than that charged to the largest private consumer. I also think they have dealt fairly with the large consumers of the district.

Cross-examined by Mr. ASPINALL: This capital, amounting to £40,000, if it were granted, would perhaps last 18 years. When the arrears are paid, and the reserve-fund is filled, if the Company do not reduce the price of gas, an application can be made to the Court of Quarter Sessions to compel them to do so. I know of cases where more than half the housekeepers decline to take gas; they prefer petroleum, because it is cheaper. At Scarborough, works are being erected for the supply of one million feet in 24 hours, and they have 5½ acres, which are all occupied. The quantity of land required increases in a decreasing ratio; small works require proportionately more land than large ones.

Mr. MICHAEL said that was the case on behalf of the promoters of the Bill.

Mr. ASPINALL said he proposed to call his witnesses before addressing the Committee.

Mr. *T. M. Ellison*, examined by Mr. ASPINALL.

I am Town Clerk of Glossop, and also Clerk to the Borough and County Justices. It was my duty, in the capacity of Town Clerk, to assist the Mayor in calling a meeting of the ratepayers. We had a requisition signed by about 30 of the most important gentlemen in our community, large millowners in the district. The meeting was to determine whether the Corporation should oppose the Bill under the Borough Funds Act. All the millowners of any importance—except one, who happened to be abroad—signed the requisition. The gentlemen making their own gas signed as well. Those gentlemen would be glad to take the gas during a portion of the year at reasonable terms, because for six months they do not require any gas at all in their mills, and, therefore, the capital is lying idle. It is a thing that they require only for a time, during the autumn, the winter, and early spring, and they would prefer to have it from the Company if they could get it at a fair price. The meeting was a crowded and unanimous one, with the exception of the Chairman of the Gas Company and one or two of his friends, who said there were some party or parties of pleasure coming to London on the strength of this opposition. The result of the poll was the numbers that have been stated—165 and 2400, and there were about 1100 votes which were lost. The borough is a place of a peculiar character; we are short of a large consuming middle class, and no gas company in the world can pay properly unless all the cottages have facilities for, and wish to take a supply of gas. It is utterly absurd, unless the price is very much reduced, that the Company should expend capital upon new works, because it will be all thrown away. The population consists mainly of operatives who work at the mills; there are a few shopkeepers and a few millowners, and there is also Lord Howard's residence, Glossop Hall, which is also within the borough. The character of the gas has been a sore subject of complaint the whole of the time that I have lived there, until a short time before this Bill was talked about; but lately they have made a great deal of improvement, and I must say that we have been satisfied with the gas during

the last three months. They are giving us 19½ candles now by Sugg's burner. There was a public meeting in 1874 about the gas—an indignation meeting, in fact—in consequence of the badness of the gas supply, as we considered that we were then very badly used. We think that we ought to be assimilated very nearly to the town of Ashton. We desire to have a sliding scale, and consider that 3s. 8d. would be a fair price. There is this objection about the new site, that if it is not necessary they ought not to have it at all. We consider that there is quite sufficient storeage room for a number of years on the present works, and also sufficient gasholder and retort room. There are over 1140 inhabitants who do not take gas, as will be shown later on. I do not know exactly why they decline to take the gas, but what has been stated about the plants growing is a perfect surprise to me; I never knew that we were such botanists. I ride about the town, and never saw a blooming flower in a cottage window yet, to my knowledge.

Cross-examined by Mr. MICHAEL: The present gas-works stand well in a corner, without creating any nuisance, but we do not want a second set of works. If the new capital is granted, I think a portion of it will be expended so as to bring in no return, and the price of gas will, therefore, stand a poor chance of being reduced, and we shall have the burden much more permanently that we have had. I was a Shareholder for only three days, when I sold my shares at a profit. I do not think persons would give an undue value for their shares. The Shareholders in the Company are the most likely men to buy up the shares at an advanced price. The Company have not lowered the price so much as they ought to have done; they raised it 5d. at the time of the coal panic, and now that has passed away they have only reduced it 3d. I think if the Company worked and managed their concern in a different manner to what they do, they might obtain a good profit; but not otherwise. The Corporation do not wish compulsorily to acquire the undertaking of the Gas Company. Their view is, that gas-works are much better conducted by a company than by a corporation. If the Company would only do right to the inhabitants, it would be much better for the works to remain in their hands, with a proper price for gas and a proper illuminating power, because the Corporation consider that a body of Directors whose interests are at stake could better attend to the working of the concern than individual Town Councillors; but at the same time they consider that when the public are not properly served—when the gas is bad and the price high—it is their duty to step in as the protectors of the public and the poor artizans, to enable them to get a better light. I also think that if the Company—having obtained an immunity almost as well as a monopoly—do not carry on their business well, and make a mistake by laying out an excessive capital, they ought not to have their dividends preserved from loss any more than a private individual. If the Company spent £10,000, and only had £8000 worth of plant and works for it, then the consumers would have to pay the dividend upon that £10,000, which had been expended through bad management, instead of £8000. The Engineer ought to say whether there was value for the money the Company claim to have spent, but they did not have an Engineer, or anybody that was up to the thing, for about 20 years. There was a highly respectable man, who was farm bailiff, and had been woodman to Lord Howard, and, along with his other duties, he attended to this Gas Company, and all the capital was expended under his direction.

MONDAY, MARCH 24.

Mr. *G. Williamson*, examined by Mr. ASPINALL.

I reside at Glossop, and among other things I collect the water-rate. The water-works are the property of Lord Howard, and they supply nearly the whole of the district. I made a house-to-house visitation of the whole district over which the gas supply extends, between the 6th and the 16th of the present month. I am also general rate collector, and collect the income-tax. The rating value of the borough is £48,148. The price charged to the Corporation for gas and street-lighting purposes is—Up to 300,000 cubic feet, 5s. 3d. per 1000; above 300,000 and under 600,000, 4s. 10d.; above 600,000 and under 1 million, 4s. 5d.; above 1 million, 4s.; all subject to a discount of 5d. per 1000 per feet, if paid within one month after the end of the quarter. The number of separate occupiers in the borough is 3596, of which number 1933 burn gas. In addition there are 1103 houses which have gas-fittings, but burn no gas, and 564 which have no gas-fittings, there being no mains near them.

Mr. ASPINALL: Did you make it your business to ascertain the reasons why this number of persons burned no gas?

Mr. RICHARDS objected to the question.

The CHAIRMAN said it was morally impossible that a servant sent round to make inquiries could do so without prejudice. They might have had the opinion of a public meeting, which would have borne weight.

Mr. ASPINALL said that had been done, but he would not press the matter.

Examination resumed: I do not think that the reason the inhabitants do not burn gas is because they are so extremely devoted to flowers. Lord Howard formerly used to hold an exhibition of flowers every year, but he gave it up because there were so few people who grew flowers. There are several millowners who make their own gas, the rateable value of whose premises ranges from £450 to £4300. The population of Glossop at the last census was 17,046, and the acreage of the borough 3033 acres; but that includes a great deal of farming land. The new road from Hadfield to Glossop is a highway from one main part of the borough more than any other, but there are no mains in it.

Cross-examined by Mr. RICHARDS: I think there ought to be mains in the road just mentioned, for the benefit of the public, and the Corporation have asked for it to be done. Laying down new mains costs money, and when companies have exhausted their capital, then is the time for them to apply for more. I think it time to extend the mains when houses begin to be dotted about where there were not any formerly, and I think they ought to have money to do it with. Those gentlemen who have private works had them erected a good many years ago. I dare say some of them had the plant which is now in existence before the gas-works were commenced. I can conceive a gentleman who has had his plant in existence a great many years hesitating to render that plant absolutely useless, and preferring to continue his own works; though, if he started afresh now, he would prefer taking gas from the Company. One manufacturer uses the Company's gas in summer, and I suppose it is convenient to him at that time to drop his own manufacture; but if the Company were not there to supply him, of course he could not obtain it.

Re-examined by Mr. ASPINALL: In the winter those millowners burn a great deal of gas, because the mills work during the hours of darkness, both morning and night; but in summer they want no gas except for their houses and offices, and, therefore, it is not worth while to carry on their own works.

Mr. *J. Stafford*, examined by Mr. ASPINALL.

I was Mayor of Glossop from 1870 to 1873. There has been a very great deal of complaint about the supply of gas, especially three or four years back. It was very irregular, but has been better since the beginning of March. Last Wednesday I tested it myself with Sugg's illuminating power meter, and it registered 19·60. It was very fair gas, but I do not think it was at all too good. During Mr. Clarke's management, the gas was very bad, and people frequently complained about it.

Mr. RICHARDS objected to the line of examination his friend was pursuing; but, after some conversation,

The CHAIRMAN said he thought it was admissible.

Cross-examination resumed: I think the sliding scale would be a very good thing, as it would be an inducement to the Company to be economical in their management, and would make the dividends rise when they made gas cheap, and fall when dear. I thought 3s. 8d. or 3s. 9d. would be a very fair price. I am aware that the Company are at present paying back dividends, besides their accruing dividends. I believe that last half year, according to their balance-sheet, they paid something like 25 per cent. more than they were entitled to. I dare say those arrears were caused during the cotton famine—or rather coal famine. I think it is very unreasonable, and is one of those things which the inhabitants of Glossop feel very much, that the present generation should be called upon to pay for losses which they are not responsible for. Everybody lost during the cotton famine, and nobody, except the Gas Company, has any means of getting it back. There are plenty of places without mains, as, for instance, the new road. The wind is no higher in Glossop than in other places, and there is nothing to interfere with telescopic gasholder plant. The site of the gas-works is very well sheltered, and there is plenty of room for extending the works. They have an unworkable gasholder there, and they might erect a workable one in its place. On the part of the Corporation, it is not desirable that the Gas Company should lay out a large amount of capital that cannot really be productive, so that the public should have gas at a proper price, and not interest to be paid on unproductive capital.

Cross-examined by Mr. RICHARDS: I never tested with Sugg's burner before, but Mr. Clarke gave me a lesson a few years ago. It was certainly not with that photometer, but the thing is so plain that any one can read it, and I had the most celebrated gas-fitter in Glossop to assist me.

Mr. RICHARDS: It is true it is very easy to read the index if you have properly adjusted the light, but that is the first thing to do.

Witness: We adjusted the light according to our own satisfaction.

Cross-examination continued: I do not know that the initial price in London is 3s. 9d. and the dividend 10 per cent., but I do not see why Glossop should pay more.

Mr. RICHARDS: Supposing the auction clauses to exist, what possible motive have the Company to lay out capital which will not be productive?

Witness: I cannot tell what their motives may be.

Can you suggest how any board of directors can have any motive in issuing capital unnecessarily, when that capital is to be put up to public auction?—It would have this effect, that the premiums they received at the sale would go to improve the property, and make it more valuable. I cannot give any other reason, but boards of directors do many foolish things.

So do corporations; but I want you to suggest how it could be in any way the interest or desire of the Directors to issue capital unnecessarily, when that capital must be issued under the auction clauses?—It is impossible for me, or any other member of the Corporation, to know what they mean, as they do not tell us.

They tell you on the face of the Bill that they ask for a certain amount of capital, and they propose to include the Auction Clauses. What concealment is there about that?—I dare say they insert the Auction Clauses because they are compelled.

Re-examined by Mr. ASPINALL: The Gas Company, rightly or wrongly, publish no accounts, except to their own Shareholders. They know the real value of the shares when they are being sold by public auction, and have thus a great advantage over the general public.

Mr. RICHARDS: My learned friend knows that, under this Bill, all the accounts will be published.

By the COMMITTEE: The Corporation of Glossop have no wish to buy the gas-works if the public can be properly served, and can get cheap gas and proper illuminating power. If the Glossop Gas Company gave something like 17-candle gas, and sell that gas at a reasonable price, I have no doubt the large millowners would take it from them instead of making their own. Glossop is rather a peculiar place. There are several months in which the gas has to be burnt not only in the mornings and evenings, but, in many places, for a great part of the day; and, from a sanitary point of view, we think it ought to be pretty good gas—about equal to 16 candles. We wish the Gas Company to be paid, but we want a proper statement of the accounts, so as to be sure that the public are being fairly dealt with. I believe 14-candle gas is the ordinary standard.

The CHAIRMAN: You must admit that you cannot have good gas without paying for it?

Witness: Exactly so; but we do not want to pay an excessive price.

Mr. *T. H. Sidebottom*, M.P., examined by Mr. ASPINALL.

I am member for Stalybridge, and a very large ratepayer of Glossop. In respect of my own works, we make our own gas almost entirely, except that I have extended my works very much lately, and have been obliged to have an additional supply from Glossop; and also in the middle of the summer when my own works are stopped. In practice, I stop my own gas-works in summer, using them only in winter, when we have to light up the mill; and it is the same at other works. At my own works, and at the adjoining works belonging to me outside the boundary of the borough, I have from 3400 to 3500 lights; and, as near as I can tell, the cost last year, when we worked full time, was £525 for the winter, whereas, if I had had the same gas from Glossop, at the lowest rate of 4s., it would have cost me £691. I am not a gas engineer, and I know nothing about how many candles it ought to be equal to; but I do know that the Glossop gas is vastly inferior to my own; so much so, that, in my own private office, when I have been writing letters, I have had to ask the men, "How is it?" and they have said, "Our own gas is turned off, and we are using the Glossop Gas Company's now." I may also mention that, after Mr. Clarke was appointed, my tenants complained to me of their bills, and yet they were only using the same quantity of gas. He managed it so well for them that the tenants had to pay double the prices they had before, while they were only burning gas for the same time, which was very much to Mr. Clarke's credit as a manager of gas-works. I cannot say, of my own knowledge, that since the introduction of this Bill the Company have improved their gas, because we used our own during the winter. There is a very strong feeling in Glossop in favour of the Corporation, and against the Gas Company. I may mention that the townships of Tintwistle and Hollingworth protested so strongly against being left to the tender mercies of the Gas Company, that they have been omitted rather than the opposition should be incurred.

By the COMMITTEE: When I say "in favour of the Corporation," I mean in favour of the Corporation looking after the Gas Company, to see that they supply better and cheaper gas.

Cross-examined by Mr. RICHARDS: I did not know until I came here that the Corporation asked for 18-candle gas at 3s. 6d. At our works we have coals specially for the gas; we used 154 tons 4 cwt. of cannel, and 432 tons of coal. We produce the gas and send it from the manufactory through a pipe to where it is to be consumed, so that there is no charge for distribution. I have always found the Glossop Gas Company very obliging, and ready to supply us. I formerly supplied Tintwistle, and I

believe the price charged was the same as that charged by the Glossop Gas Company. I fancy the reason why my tenants paid more for their gas was because air was mixed with it.

Mr. RICHARDS: I should think you to be aware that if half air and half gas were supplied, you would get no illuminating power.

Witness: It might be because the illuminating power was lowered.

By the COMMITTEE: I really do not know whether the quality of the gas may, to some extent, be attributed to the fittings. My tenants had my own fittings. The reason why I discontinued supplying them was because my works were not sufficiently large. I therefore sold the plant to the Glossop Gas Company—in fact, I may say I gave it them—for £100. My tenants grumbled very much, and wished me to take the works back.

Mr. *T. Newbigging*, M. Inst. C.E., examined by Mr. ASPINALL.

I have had over 20 years experience in the management and construction of gas-works. I have read the proposed Bill, and also the Acts of 1845 and 1855. Under the 37th clause of the Act of 1845, the Company have complete control over the fittings up to the burner inclusive. The main cock which has been produced is the inlet to the meter, and the Company could object to it if they chose. Wherever a leakage arises in consequence of such fittings as those, it would be to the Company's loss entirely, because the gas would not be registered. Fittings of that kind are very imperfect, because they would be sure to leak. Even if such things were not under the control of the Company, they ought to be. I paid one visit to the gas-works, and inspected them as carefully as I could, and I have also viewed the site of the proposed new works. I say, without the slightest hesitation, that at least double the quantity of gas could be produced upon the existing site. One-half only of the retort-house is occupied by retort-beds. The present gasholder storeage is sufficient for the make, and it could easily be duplicated by telescoping each of the holders, so that there could be a double production and a double storeage without the slightest difficulty. Sometimes retort-houses are made rather large, so that coal may be stored in them; but here the Company have also a coal store, which is only half occupied. I have examined the accounts, and find that the increase in the consumption during the past ten years has been only 54 per cent., or at the average rate of 5½ per cent. per annum; but it is really only 4 per cent. increase compound interest. If the same rate of increase continues, the present site would last for 18½ years to come; but, supposing the future rate of increase should be 8 per cent., the site would then last 14¼ years. In order to utilize the present site, more capital will be required, and I have come to the conclusion that £16,000 share capital and £4000 loan capital will be sufficient. The withdrawal of the enlarged district will necessarily lessen the amount of capital required. The usual plan has been to grant a company applying for additional capital as much as will tide them over ten or twelve years.

By Mr. RICHARDS: I think it is a very wise precaution to limit them to that time, notwithstanding the auction clauses.

Examination resumed: I think, in small places, it is desirable that the consumers should have an opportunity of airing their grievances, whether just or unjust, within a period of ten or twelve years. In great towns, public opinion can be brought to bear upon the Companies, which cannot be done in smaller places. If the Company are enabled to take this new site, and erect works upon it, the large increase of revenue which would be required to pay dividend upon the increased capital will put it beyond their power to reduce the price of gas probably during the present generation. The existing capital is £34,000, of which £1800 has not been called up, and that has lasted them for 34 years. If that were increased by £20,000, it would make the capital £54,000, which would last until the present production of gas was doubled. The capital expenditure, as compared with the quantity of gas sold, is excessive, being at the rate of £1085 per million feet of gas sold per annum. The usual rate is from £700 to £800, although many towns are as low as £500 or £600. Taking into consideration the excessive capital expenditure, I think the payment of back dividends should cease, particularly as the Company have converted all their loan capital into share capital. I have no objection to the payment of back dividends as a rule, but I should prefer to see the Company obtain their extra percentage through the operation of the sliding scale. I think the maximum price of 6s. now proposed is much too high. I find, from the Company's published accounts, that the cost of manufacture and distribution per 1000 feet sold is 2s. 5·64d., and a further sum of 1s. 7·57d. is required to pay interest on loans and the maximum dividend upon the present share capital. Those two sums added together give 4s. 1d. as the price at which gas might, under present circumstances, even with the Company's extraordinarily heavy leakage, be sold, and therefore I think that 4s. 6d. might be named as a reasonable maximum. I do not see anything in the district to justify such a heavy leakage as 21 per cent. It is not undermined, nor is it a very straggling district, comparing it with many manufacturing places in the North. I should say 12 per cent. would be a fair and reasonable leakage for such a district; and, if it were reduced to that, the saving per annum to the Company would be £372—equal to 3d. per 1000 feet sold—and that would give 3s. 10d. as the price at which gas might be sold to cover all expenses and pay the maximum dividend. A maximum of 4s. 6d. would leave 8d. per 1000 feet as a margin to meet any contingencies. The following is a list of Gas Companies and Local Authorities owning gas-works, with their maximum price per 1000 feet:—Altrincham, 4s. 6d.; Ashton-under-Lyne, 3s. 8d. initial; Birstal, 4s. 6d.; Bolton, 4s. within borough and 4s. 6d. without; Bradford, 4s.; Cleckheaton' 4s. 6d.; Congleton, 4s. 6d. within borough and 5s. without; Dewsbury, 4s. 6d.; Heckmondwike, 4s. 6d.; Leeds, 3s. 9d.; Macclesfield, 4s.; Shipley, 4s. 2d.; Southport, 4s. 6d.; Sowerby Bridge, 4s. 2d. without and 5s. within; Todmorden, 4s. 8d.; West Houghton, 4s. 6d.; and Wrexham, 4s. within and 4s. 6d. and 5s. without. I am of opinion that it would be just to the consumer and advantageous to the Company to introduce the sliding scale, because it would produce a more economical administration of their business. I would fix the initial price at 3s. 10d., which I think is an exceedingly fair rate, and would be a direct incentive to the Company to alter such fittings as these [producing a specimen]; because so long as they can charge a high price, there is no real motive for improving the administration of affairs. The illuminating power fixed in the Bill is 14 candles, but I think that is too low. The Company at present profess to supply gas of 18-candle value. I do not see why the maximum should not be 16 candles. The practice is almost universal in the North to sell gas of from 18 to 20-candle illuminating power, and I have here a list of such towns, with the minimum illuminating power as fixed by the special Acts:—Ashton-under-Lyne, 16; Blackburn, 16; Bolton, 16; Fleetwood, 16; Hindley, 16; Leeds, 16; Littleborough, 15; Liverpool, 20; Macclesfield, 18; Middleton and Tonge, 18; Milnrow, 16; Preston, 18; Todmorden, 17; Tyldesley, 16; Warrington, 16; West Houghton, 16; Wigan, 18; Wilmslow, 18; and Windermere, 16. If a very wide margin is given between the minimum and the quality usually supplied, there is a great liability to fluctuation in the quality of the gas; but if the minimum is raised, that fluctuation is to a great extent prevented. The oscillation between 14 and 18 candles is very objectionable.

Cross-examined by Mr. RICHARDS: I know all the towns in the North which I have spoken of, and I also know that 18-candle gas has been the rule in Glossop.

Mr. RICHARDS: Then do you not think it is rather extraordinary that people should say that the quality of the gas is so bad that they will not burn it?

Witness: I know they have said that, but I do not always agree with a consumer's opinion as to the quality of the gas. That [pointing to a specimen of gas-fittings] may account for it.

What is your authority for saying—because we distinctly deny it—that our gas is generally 18-candle gas?—I know you are reputed to give that.

You must have had experience enough to know that such an answer as that "we are reputed to give," is not an answer to my question. Have you tested the gas yourself?—I have noticed the quality, but I have not tested it.

I suppose you never recommended 18-candle gas at 3s. 6d.?—Not at all. But possibly putting in 18 when we put in 14 was not a bad bid for the Committee to make 16 as a sort of compromise?—I dare say that was the intention—to bring you up a little bit; but I really cannot tell.

Cross-examination continued: I admit that the usual illuminating power is 14 candles, because there are more small southern towns than northern towns, but 16 is by no means the exception. I was at one time Manager of the Rossendale Union Gas-Works; the illuminating power mentioned in their Act of 1876 was 14 candles, but their supply is invariably equal to 18 candles. That was an unopposed Bill.

Mr. RICHARDS: Then how came it that you allowed the Company to take advantage of Parliament by putting in 14 candles for a place in Lancashire where they ought at least to give 16, if not 18?

Witness: I did not allow them to take advantage of Parliament at all. If the people were satisfied with 14 candles, I had nothing to do with it.

Are you aware that in the course of the last 15 years there have been passed about 360 Gas Acts, of which number 292 have been passed with 14-candle gas?—Probably that is so.

Something over 80 per cent.?—Yes; but what percentage of northern towns?

I cannot give you that, but a very large number.—Particularly if the Bills are opposed. If they are unopposed, it is a different thing altogether.

What you appear to have done is to select every place where the illuminating power is more than 14 candles?—I have done that purposely, to show that it is not an exceptional thing to have 16 or 18 candles.

With regard to the price, you will hardly doubt that London is a place that ought to be supplied cheaper than Glossop, and that it is cheaper to supply a large concentrated population?—I do not know about that at all, because in Manchester the price is 3s.

We know that has been done by making the consumers pay pretty smartly for some years past.—But in Bury, a much smaller town than Manchester, the price is 2s. 8d.

Does it not strike you that nothing can be more utterly whimsical and misleading than to take any set of towns and compare them, without showing the particulars of each, and the bearing they have to each other?—I do not think so.

Respecting the back dividends, does it not strike you as being liberal—although I am afraid to suggest liberality—that when the Company might have charged 6s., and so made good all their back dividends, in point of fact they only charged 5s., with a discount of 5d.?—I think it would have been bad policy to charge 6s., because they would have lost many consumers.

Cross-examination continued: The Shareholders who bought of late years, I suppose, did so upon the faith of receiving the back dividends, and I would give them the opportunity of so doing by the operation of the sliding scale. I think the proposed site is a very fair one. If the Company had to be newly established, I would not recommend the present site, because I think it is objectionable in the midst of a large population; but seeing that they are there, and that there is no complaint, because the works are very nicely managed, I do not see any reason for removing to the new site.

Mr. RICHARDS: With regard to the new capital, will you tell me what earthly difference it makes whether the amount asked for is £40,000 or £100,000, if the auction clauses are introduced?

Witness: According to the Standing Orders, the capital has to be issued either by auction or tender, and I know that if it is issued by tender it will fall into the hands of the existing Shareholders, because they know its value more than the outside public; and, therefore, I say that, in spite of the auction clauses, there is an advantage. If, however, they are put up to auction there is less danger of the Shareholders or Directors becoming possessed of them. The tender must be at least equal to the reserve price forwarded to the Board of Trade; but that reserve price may be fixed at a low rate, because the outside public are not likely to know the value of the shares so readily. When shares are sold by auction, every one present has an opportunity of appraising their value; but when they are sold by tender, the transaction partakes more of a private character, and the outside public are not so likely to come in and buy. Besides, the electric light scare and the bad trade in Lancashire and the neighbourhood have upset altogether the premium upon the shares, and we cannot exactly say what their value is. It is to the interest of the Corporation of Glossop that the shares should command as large a premium as possible. What they wish is to see gas sold at a reasonable price, and still pay the Company their maximum dividends.

The 10 per cent.?—Not at all; I mean on the original capital.

Do you suppose you could take that dividend away from the old capital?—The Corporation are in favour of the Company having their maximum dividends, but they wish to have gas sold at a reasonable price. As years roll on, it would be desirable that the Company should have the option of removing to another and comparatively suburban district; but that will not be necessary for 12 or 14 years, and within that period I should wish them to apply to Parliament again.

Mr. ASPINALL said he wished first to draw the attention of the Committee to the question, for whom, under the circumstances, was Parliament now asked to legislate? The Gas Company maintained that they had carried on their works well since their incorporation, except during a period when nearly everybody in the country lost money, and very few people, except, as it appeared, the Proprietors of those gas-works, had been able to get it back again. The Company was a private one, and when such a company came before Parliament, whether for original or additional powers, he apprehended they must show that they were not acting in their own interests, but in those of the public. But were the Glossop Gas Company so acting? If they had applied for powers to light the townships of Hollingworth and Tintwistle, they would have ground for asking the people of Glossop not to be selfish in their opposition, but to allow a Bill to pass unopposed which was to effect the benefit of another portion of the public. In 1874 there was a large meeting of the inhabitants of Glossop, denouncing the proceedings of the Gas Company, and, again, only a few months ago, when it was found that the present Bill was in contemplation, the inhabitants of Glossop were called together, as required by law, for the purpose of dealing with the question, and they unanimously decided to authorize the opposition. The Chairman of the Company had the imprudence to ask for a poll, which resulted in an overwhelming majority against the Bill. Should not the Company be called upon to show that what they asked for was for the public benefit? How did the Com-

pany stand at present? According to their own showing their works were sufficient for all they required at present, because they had abandoned the idea of supplying a new district. Perhaps, if they had been pressed, it would have transpired that the proposed new district wanted the Company as little as the old, and that the new district had been abandoned in order to avoid opposition. But the same amount was still asked for, as if no alteration had been made. He asked that the Company should be limited to their present site, and that the capital granted should be no more than £16,000 share and £4000 loan, which would give the Company in reality rather more than that sum, because the premiums obtained must be added. With regard to the rest of the Bill, exclusive of the question of capital, he objected to it altogether, and particularly to the proposed new site. It was not sufficient to say it was for the good of the Company, if it would do no good to the people of Glossop. There was shown to be plenty of room for extension on the existing site, and the whole public opinion of Glossop was opposed to a new one. The Committee ought not, therefore, to thrust down the throats of the people of Glossop that to which it was shown they were opposed. A grant of powers for the additional site would involve an outlay of money, foolish in itself, and which would consequently be for ever a burden upon the inhabitants of the borough. As to the Company itself, he did not think that the two gentlemen who were first called as witnesses were such men as most people would be inclined to trust their money to. No doubt, with the usual capacity of small tradesmen, they had made the thing pay themselves, but their incompetency had been shown by their mode of procedure. At first they had no manager, but afterwards they appeared to have had Lord Howard's wood bailiff, and he, it was to be supposed, in conjunction with the gentleman who supplied the unsatisfactory fittings, had fitted up those works. It was not, therefore, surprising that the price of gas was high. With reference to the very large number of houses which were not supplied with the Company's gas, a suggestion had been made respecting floriculture, which was supposed to account for it; but, as a matter of fact, a flower would not grow at Glossop Hall; and, when the supporters of the Bill were driven to such a notion as that, they must have been very hard up. The Gas Company had not been successful in pleasing the public, and therefore the Committee would be asked to reject the Bill. In regard to the sliding scale, the learned counsel said that the intense dissatisfaction with the Company which existed in Glossop was a thing to be removed by all possible means, and upon that ground, amongst others, he advocated it. It would be for the benefit of a well-managed company if the initial figure was fair, because it gave scope, by economy and good management, to increase the dividend, by lowering the price; while, on the other hand, the Company would be punished if it exceeded the initial figure. The public, in desiring to have the gas question settled by the establishment of a sliding scale, wished to bring to the real test the question of whether their grievances had been right or wrong. The Committee were also asked to decide upon a price being assured that, whatever they thought fair and reasonable, the population of Glossop would be content with.

Mr. Richards, in replying upon the whole case, maintained that the standard of 14 candles was general throughout England, and he referred to the evidence of Mr. Newbigging upon that point. Statements as to the standard and price prevailing in different districts were quite unfair, unless they were accompanied by evidence of the peculiar circumstances existing in each case. The suggestion in the petition for 18-candle gas was perfectly ridiculous, and if the Company worked at 14 candles, under penalties they would be bound to work at 15, by which the public would have the advantage of an extra candle. As to the sliding scale, it would be an advantage if the Committee, in stating that the preamble of the Bill was proved, would append an opinion as to that matter. Where there were, as in the present case, two rates of interest payable on the shares, complications would arise, for the diminution or increase of one penny would, of course, bear two distinct proportions of 10 per cent. and 7½ per cent. With regard to the price to be charged, it had been proved that at least 4s. 7d. per 1000 feet was required for the production of the gas, without making any provision for reserve-fund, insurance-fund, and so on, all of which Parliament contemplated. He therefore asked the Committee to fix such a maximum as would leave a reasonable margin to provide for an emergency such as that experienced in the coal famine. Gas was cheaper to burn, at the rate supplied by the Company, than anything else which a poor man could make use of, and the absence of consumers must be attributed, not to the bad quality of the gas, but to the cost of providing the original fittings. It might be that, in cases where an outgoing tenant could not prevail upon the incoming tenant to take the fixtures, they were taken down; but, no doubt, if the landlords would go to the expense of putting up proper fittings in their houses, the tenants would gladly make use of the gas. In regard to the question of site, he (Mr. Richards) should have thought that the Board of Health would have been only too glad to have the gas-works removed from the populous part of the town into an open space. The opposition to the Bill was to be deprecated, not only as vexatious and useless, but on account of its cost. The Gaslight and Coke Company had applied for powers to the extent of two millions, and in proportion to that, what was the sum of £4000 or £5000 expended in the cost of the opposition? But here was a Company asking for £40,000, and the cost of obtaining it—some £2000—was an enormous tax upon that amount; and it was not, therefore, desirable that the Company should be compelled to make repeated applications for additional powers. If the capital now sought for were granted, no harm would be done, owing to the operation of the auction clauses. The Company could gain nothing by the issue of capital, and, therefore, the amount of the power was immaterial. Their object would be not to issue capital until it was absolutely necessary, and would be immediately remunerative, and then to issue it under circumstances which would produce the largest possible maximum.

The committee-room was then cleared. On the counsel and parties being again called in,

The Chairman said the Committee were of opinion that the preamble of the Bill was proved.

Mr. Aspinall inquired whether that decision dealt with the sliding scale.

The Chairman said the Committee considered that it was not desirable that the sliding scale should be adopted.

Mr. Aspinall said that his clients could not, therefore, take any further part in the proceedings.

The clauses were then proceeded with.

Upon clause 28,

The Chairman said that the Committee wished to increase the number of candles to 15.

Mr. Michael: Of course, Sir, I must bow to your decision, but I quite understood you to say on Friday that you were satisfied as to the question of illuminating power, and, therefore, I did not pursue it any further.

The Chairman: What I said was that you need not labour the question as to the general illuminating power of the gas supplied by different companies. I knew of my own knowledge that the ordinary standard was 14 candles, but I did not go further than that.

The remaining clauses of the Bill were then agreed to, with amendments, and the Chairman was directed to report the Bill, as amended, to the House.

Miscellaneous News.

THE REGISTRAR-GENERAL ON THE WATER AND GAS SUPPLY OF LONDON.

In his Annual Summary for 1878, the Registrar-General says: "In the absence of municipal arrangements for supplying London with water and gas, those two necessaries of life are supplied by Gas and Water Companies at great cost, as is shown in the annexed table.* The paid-up capital of the Gas and Water Companies was £23,860,000, which might be borrowed by the Metropolitan Board of Works for £954,400 a year, whereas the net revenue of the Companies was £1,882,765. The Companies, therefore in addition to the interest of £954,400, gain £928,365 from the ratepayers of the Metropolis. Thus the gas shareholders gain £9·263 per cent. for their stock, and the water shareholders gain £6·552 per cent. for their stock. This is partly accounted for by the speculative nature of their investments. The New River obtained no dividend at all for the first 20 years, and several of the other Companies obtained little interest in the first years of their existence. Then there is risk that the dividends will only be realized for a limited number of years. Gas might be superseded in a few years, and in a few years Thames water might be superseded by a purer water, in which case the dividends might cease. The capital embarked in the production of gas and in the supply of water is at risk, and it is on that ground that so much more than 4 per cent. has hitherto been charged. The Shareholders have been paid for the risk their capital incurred.

"Should the electric light be utilized, it will naturally be done by the Metropolitan Board of Works, and should London be supplied by purer water on the plan proposed by Mr. Bateman, or on the plan advocated by the Metropolitan Board of Works, it will be right to offer some compensation to the Gas and Water Companies for the services they have rendered. 'If no water-works existed in London, 100 million gallons of fresh water a day could be supplied from Wales for an annual expenditure of £470,000, covering interest of capital (4 per cent. on £8,000,000) and working expenses at an annual charge of £150,000.' This estimate by Mr. Bateman, who constructed the Manchester Water-Works, and the water-works of Glasgow, which is supplied from Loch Katrine, is satisfactory proof that London could be supplied on the constant system, by which fires are so readily extinguished, for £470,000, whereas £1,283,548 is now paid for waters polluted more or less by the sewage of innumerable towns.† No doubt the chalk stratum round London contains a vast store of water, which would furnish a large portion of the supply required.

"Several town councils have purchased the rights of the gas companies and of the water companies, and have acquired the power to supply their constituents with those two necessaries of life. They have thus far converted their municipalities into co-operative societies; and there appears to be no reason why they should not embrace the supply of other articles within their functions. Thus, Mr. Chamberlain, who induced the Town Council of Birmingham to buy up the Birmingham Water Company with the best effect, has proposed to the same body to buy up the public-houses. This would enable them to regulate the sale of alcoholic drinks, which would become at the same time a source of profit to the town."

METROPOLIS WATER SUPPLY.

Report on the Analysis of the Water Supplied by the Metropolitan Water Companies during the Several Months of the Year, 1878.

By Professor Frankland, D.C.L., F.R.S., &c.

Royal College of Chemistry, South Kensington Museum, Feb. 18, 1879.

The Registrar-General.

Sir,—In the accompanying tables ‡ I have to submit to you the results of the chemical examination of the water supplied to the inner and portions of the outer circle of the Metropolis during the year 1878.

London (inner circle) was supplied during this year by eight companies, with a daily average of 129,657,848 gallons of water. Of these, 65,063,839 gallons were often much polluted with organic matters of animal origin; 56,501,022 gallons were occasionally so polluted, but much less intensely; whilst only 8,092,987 gallons were uniformly delivered in a pure and wholesome condition.

The temperature of each sample at the time of collection, and its appearance when seen in a glass tube 2 feet in length, have been recorded, and whenever the samples were turbid, a microscopical examination of the sediment deposited by the water, after standing for some hours, has been made.

Table A gives the temperature of the water as it issued from the main. Classifying the waters into three groups, according to their sources, the following variations were observed:—

The temperature of the Thames water supplied by the Chelsea, West Middlesex, Southwark, Grand Junction, and Lambeth Companies, varied from 4·3° C. (39·7° Fahr.) in January and December, to 20·3° C. (68·5° Fahr.) in July. The range was, therefore, greater by 2·3° C. (4·1° Fahr.) in 1878 than in 1877. The higher temperature just mentioned causes the water to taste vapid and disagreeable.

The temperature of the Lea water, delivered by the New River and East London Companies, ranged from 3·8° C. (38·8° Fahr.) in January and December, to 19·8° C. (67·6° Fahr.) in July, when this water was thereby also rendered unpalatable. The range of temperature of the Lea water was exactly the same as that of the Thames water, and was 1·7° C. (3·1° Fahr.) greater in 1878 than in the previous year.

The deep well water delivered by the Kent and Colne Valley Companies showed a minimum temperature of 7·2° C. (44·9° Fahr.) in February, and a maximum of 13·4° C. (56·1° Fahr.) in July, August, and September. The temperature of this water, even in the hottest weather, never interfered with its palatability.

Thus it will be seen that the temperature of the river waters ranged through no less than 16° C. (29·0° Fahr.), whilst that of the deep well waters varied through only 6·2° C. (11·2° Fahr.) and the range was 1° C. (1·8° Fahr.) less in 1878 than in 1877.

Table B shows the proportion of solid matters contained in 100,000 parts

* *London Water and Gas Companies.*—Total paid-up capital (including amount received on calls paid in advance), revenue, and expenditure of the Metropolitan Gas and Water Companies for the last financial year ended prior to April 1, 1878.

—	Total Paid-up Capital (including Calls Paid in Advance).	Total Gross Revenue.	Revenue from Gas, Meter, and Water Rents.	Total Working Expenditure.
	£	£	£	£
Gas Companies	11,825,750	3,536,794	2,755,750	2,442,501
Water Companies . . .	12,034,254	1,297,874	1,283,548	509,402

† See Cholera Report, Appendix to 29th Report of Registrar-General, pp. xl. to xlvi.

‡ Table I. is the only one we publish, as Dr. Frankland's comments on the others will be sufficient for the great majority of our readers.—Ed. J. G. L.

by weight of water. This solid matter consisted of a great variety of substances, by far the larger proportion being saline, and entirely harmless when the water was used for dietetic purposes, but decidedly injurious when used for washing, because it was thereby rendered hard. A small proportion only of the total solid matter was made up of organic substances, but these are always objectionable, and at times, especially when present in river water, they are dangerous to health. The average proportion of total solid matters in all three classes of waters was greater last year than in 1877. The highest proportion was found in the deep well water delivered by the Tottenham Local Board of Health, and the lowest in that supplied by the Colne Valley Water Company. Both these waters are derived from the same source, but the Colne Valley Company's water is softened by Clark's process, whereby a very large proportion of its solid matters is removed.

Tables C and D show the proportion of two of the most important constituents of organic matter—carbon and nitrogen. They are, therefore, the expression of the relative quantity of organic impurity actually present in the waters. This expression of impurity is of great importance from a hygienic point of view, because the organic pollution of the Thames and Lea consists to a great extent of the excreta of men and animals. During the past year these rivers were much more polluted by organic matters than they were in the year 1877; and in the months of January, May, June, July, September, November, and December, the Thames water was so much polluted as to be unfit for dietetic purposes. Taking the mean proportion of organic impurities in the Thames water delivered in London in 1868 as 1000, I find that in the subsequent years, 1878 included, the following proportions were present:—

Year.	Proportion of Organic Impurity present in Thames Water as delivered in London.
1868	1000
1869	1016
1870	795
1871	928
1872	1243
1873	917
1874	933
1875	1030
1876	903
1877	907
1878	1056

Only once since these observations were commenced has the Thames water delivered in London been so much polluted by organic matter as during the year 1878. The Thames was often in high flood even in summer, and much filthy matter, ordinarily retained in sewers and cesspools during the summer months, was swept into the river.

The Lea water maintained its usual pre-eminence over that abstracted from the Thames; nevertheless, in June and December this water was also unsuitable for dietetic purposes. Taking, as before, the mean proportion of organic impurity in the Thames water supplied to London in 1868 as 1000, I find in that and subsequent years, down to 1878 inclusive, the following proportions in the Lea water delivered by the New River and East London Companies:—

Year.	Proportion of Organic Impurity present in Lea Water as delivered in London.
1868	484
1869	618
1870	550
1871	604
1872	819
1873	693
1874	583
1875	751
1876	562
1877	596
1878	747

The inferiority of the East London Company's water was much more marked than that of the New River Company's water.

Table E. If, for the purposes of comparison, the amount of organic carbon and organic nitrogen found in the Kent Company's water during the nine years ending December, 1876, be taken as unity, this table shows the maximum, minimum, and average proportions in each of the waters supplied during the year 1878 to be as follows:—

Sources.		Max.	Min.	Aver.
Deep wells	Kent	1·8	0·85	1·3
	Colne Valley	2·0	1·0	1·5
	Tottenham	1·4	0·7	1·1
River Lea	New River	4·2	1·7	2·6
	East London	4·6	2·3	3·5
River Thames	Chelsea	5·2	2·9	4·0
	West Middlesex	5·9	2·9	4·2
	Southwark	6·3	2·7	4·3
	Grand Junction	7·8	3·1	4·4
	Lambeth	5·9	3·1	4·4

These numbers show that the river waters were, on the average, of a much lower quality than the deep well waters, which were always pure and wholesome; and that the Thames water was much inferior to that abstracted from the Lea.

The following table exhibits the maximum amount of organic pollution in the Thames and Lea waters from 1868 to 1878 inclusive, the average of the samples from each source in the month of greatest pollution being taken for comparison.

Maximum Amount of Organic Pollution.

Thames.			Lea.		
Year.	Elements of Organic Matter in Parts per 100,000.	Month in which Maximum Pollution Occurred.	Year.	Elements of Organic Matter in Parts per 100,000.	Month in which Maximum Pollution Occurred.
1868	·45	January.	1868	·27	February.
1869	·60	February.	1869	·33	February.
1870	·42	January.	1870	·30	January.
1871	·52	October.	1871	·22	February.
1872	·48	Jan. & Dec.	1872	·39	December.
1873	·46	January.	1873	·33	January.
1874	·37	March.	1874	·21	March.
1875	·49	November.	1875	·28	November.
1876	·44	December.	1876	·24	March.
1877	·40	January.	1877	·30	January.
1878	·36	December.	1878	·26	June.

It is thus evident that although both the Thames and Lea were, on the average, much more polluted in 1878 than in 1877, they were never so intensely polluted in 1878. This is doubtless owing to the more frequent scouring out of the sources of pollution of these rivers by floods.

In reference to the organic elements in the foregoing tables, I quote the following opinion of the late Rivers Commissioners from their report on the domestic water supply of Great Britain, p. 5:—"We consider that potable water which contains organic matter, even only partially derived from animal sources, should not yield much more than 0·1 part of organic carbon in 100,000 parts of water." The organic elements mentioned in the foregoing table consisted chiefly of organic carbon; and it will, therefore, be seen that the maximum pollution in the Thames greatly exceeded the standard, whilst that of the Lea was also considerably above it; indeed, during the entire year 1878, the organic carbon in Thames water never fell below 0·133, whilst in the case of the less polluted Lea, it only twice fell below 0·1.

Of the waters supplied from the Thames, that delivered by the Chelsea Company was the best, and that distributed by the Grand Junction Company the worst. Of the water drawn from the Lea by the New River and East London Companies, that supplied by the former was much the better.

The water drawn from deep wells by the Kent and Colne Valley Companies and by the Tottenham Local Board of Health was uniformly wholesome throughout the year, and of most excellent quality for dietetic purposes.

Tables F ["Ammonia in 100,000 Parts of the Waters"] and G ["Nitrogen as Nitrates and Nitrites in 100,000 Parts of the Waters"] need no comment.

Table H gives the total weight of combined nitrogen, and this constitutes the total evidence of both past and present pollution by nitrogenous organic matter. During the spring and summer months, this combined nitrogen in river water is much diminished by animal and vegetable life then abundant in the streams, and consequently, as an indication of pollution, the combined nitrogen found during the months when vegetation is dormant should alone be taken into account. During the months of January, February, March, October, November, and December, 1877, the average proportion of total combined nitrogen in 100,000 parts of Thames water was 0·291 part. In January, February, March, April, November, and December, 1878, it was 0·270 part.

In the same quantity of water derived from the Lea it was 0·277 part in 1877, and 0·308 part in 1878.

The deep well water supplied by the Kent and Colne Valley Companies and by the Tottenham Local Board is unaffected by animal or vegetable life, and the average may, therefore, be taken on the whole year. In 1877 it was 0·458 part, and in 1878 it was 0·446 part in 100,000 parts of the water.

The evidence of previous animal contamination in the Thames and Lea water is of serious importance, owing to the likelihood of morbific matter derived from animal excreta being carried down these rivers and distributed to the customers of the respective companies drawing their water from these sources. But the evidence has not the same significance in the case of deep well waters, because these have been exhaustively filtered and purified by percolation through great thicknesses of porous strata.

Table I shows the proportion of chlorine found in the different samples submitted to analysis; it affords no evidence that the tidal waters of the Thames or Lea had, during the year 1878, obtained entrance to the reservoirs of the Water Companies.

Table K exhibits the hardness of the different waters; that is to say, the weight of carbonate of lime, or its equivalent of other soap-destroying substance, found in 100,000 parts of water. The average hardness of the Thames water delivered in London was 19·5° or parts in 1877, and 20·3° or parts in 1878; of the Lea, 20·0° or parts in 1877, and 21·0° or parts in 1878; of the Kent Company's water, 27·5° or parts in 1877, and 28·4° or parts in 1878. Of the water supplied by the Tottenham Local Board, 26·5° or parts in 1877, and 27·3° in 1878; and of the Colne Valley Company's water, 5·1° or parts in 1877, and 7·3° or parts in 1878.

All the waters were, therefore, harder in 1878 than in 1877, and the only water delivered in London fit for washing was that of the Colne Valley Company. This water is softened by Clark's process before distribution, and is thus rendered suitable for washing, while its excellency for dietetic purposes is not thereby impaired.

All hard water *must* be softened before it can be used for washing linen. When it is softened in detail by the laundress, the operation costs, for an equal volume of water, at least eighty times as much as it costs when conducted on a large scale by a water company.

Lastly, Table L shows the annual average of each determination, and thus summarizes the average results of the analysis of the water supplied by each Company during the year.

The following table gives the results of my observations in reference to the degree of efficiency of filtration of Thames and Lea water distributed by the various Companies in 1878:—

Companies or Local Authorities.	Number of occasions when Clear and Transparent.	Number of occasions when slightly Turbid.	Number of occasions when Turbid.	Number of occasions when very Turbid.
Thames.				
Chelsea	11	1	0	0
West Middlesex	11	1	0	0
Southwark	8	4	0	0
Grand Junction	8	3	1	0
Lambeth	10	1	1	0
Lea.				
New River	10	2	0	0
East London	11	1	0	0
Deep Wells.				
Kent	12	0	0	0
Colne Valley	12	0	0	0
Tottenham Board of Health	12	0	0	0

This table shows that during the past year no Company, drawing its supply from a river, delivered water at all times in an efficiently filtered condition; but for the first time in ten years, during which these observations have been made, the water sent out by the West Middlesex Company was slightly turbid, and that only on one occasion.

The natural filtration which the Kent, Colne Valley, and Tottenham deep well water undergoes, through an enormous thickness of chalk, renders artificial filtration unnecessary, and ensures the uniform clearness and transparency of the water drawn from this source.

When examined by the microscope, the sediment deposited by turbid water on standing is generally found to contain living and moving organisms. During the year 1878 these organisms were observed in the West

Middlesex and Lambeth Companies water once, and in the water of the Grand Junction and Southwark Companies three times.

The annexed table exhibits the results of microscopic examinations during the past ten years:—

	Number of occasions when Moving Organisms were found.									
	1869.	1870.	1871.	1872.	1873.	1874.	1875.	1876.	1877.	1878.
Chelsea	3	2	2	3	2	5	4	4	1	0
West Middlesex	0	0	0	0	0	0	0	0	0	1
Southwark	8	1	4	1	2	5	5	7	5	3
Grand Junction	4	1	1	2	3	5	7	3	3	3
Lambeth	5	0	4	6	3	4	5	4	1	1
New River	0	0	0	0	1	1	0	0	1	0
East London	4	3	3	1	0	2	0	0	0	0
Kent	0	0	0	0	0	0	0	0	0	0
Colne Valley	–	–	–	–	–	–	–	–	0	0
Tottenham	–	–	–	–	–	–	–	–	0	0

Owing to the frequent and heavy floods, the river waters were often much polluted, and extremely difficult to filter, whilst the deep well waters maintained their usual brilliancy and purity.

(Signed) E. Frankland.

Table I.—*Averages for* 1878.

(The numbers in this Table relate to 100,000 parts of the Waters.)

Companies or Local Authorities.	Temperature in Centigrade Degrees.	Total Solid Matters.	Organic Carbon.	Organic Nitrogen.	Ammonia.	Nitrogen, as Nitrates and Nitrites.	Total combined Nitrogen.	Chlorine.	Total Hardness.	Proportional Amount of Organic Elements, that in the Kent Company's Water during the nine years ended December, 1878, being taken as 1.
Inner Circle.										
Thames—	Deg.									
Chelsea	11·0	28·12	·205	·030	000	·173	·204	1·57	20·0	4·0
West Middlesex	11·6	28 64	·216	·039	·000	·178	·226	1·56	20·2	4·2
Southwark	11·6	28 92	·219	·035	000	·186	·220	1·56	20·5	4·3
Grand Junction	10·5	29·15	·233	·038	·000	·181	·219	1·55	20·2	4·4
Lambeth	11·0	29·67	·229	·032	·000	·205	·237	1·57	20·6	4·4
Lea—										
New River	11·3	28 17	·129	·023	·000	·239	·263	1·55	20·6	2·6
East London	11·0	30·38	·181	·027	·000	·190	·220	1 80	21·3	3·5
Deep Wells—										
Kent	11·8	43·50	·064	·015	·000	·484	·499	2·51	28·4	1·3
Outer Circle.										
Colne Valley	10·6	15·42	·069	·017	·002	·310	·337	1·41	7·3	1·5
Tottenham B'd of Health	—	47·53	·054	·014	·000	·483	·503	3·39	27·3	1·1

Meeting of Vestry Delegates in St. Martin's-in-the-Fields.—The adjourned meeting of the delegates from the Metropolitan Vestries, to discuss the question of the water supply of London, was held last Thursday—Mr. E. J. Watherston again presiding—when it was proposed by Mr. Smith, seconded by Mr. Lacey, and, after some discussion, resolved—"That a memorial be presented to the Home Secretary to induce the Government to apply the remedy required to meet the evils complained of." What these "evils" exactly are was not made plain by the speakers at the conference; but as a Committee was afterwards appointed to draw up the details of the memorial, it will doubtless soon be known of what, if anything, the delegates have to complain in regard to the water supply of the Metropolis.

Lieut.-Col. Bolton reports that the state of the water in the Thames at Hampton, Molesey, and Sunbury (where the intakes of the West Middlesex, Grand Junction, Southwark and Vauxhall, Lambeth, Chelsea, and East London Companies are situated), was indifferent from the 1st of March to the 7th; it then improved and became clearer, and remained in a good condition during the rest of the month. The highest flood state of the river at West Molesey during the month was 3 feet 7 inches, and the lowest 1 foot 2 inches above the summer level, the rainfall at this place being 0·67 inches. The water in the River Lea was indifferent during the early part of March.

SINGAPORE GAS COMPANY, LIMITED.

The Annual Ordinary General Meeting of this Company was held at the City Terminus Hotel, Cannon Street, London, on Tuesday, the 22nd inst.—H. P. Stephenson, Esq., in the chair.

The following are the report and accounts presented to the Shareholders:—

The Directors have to report continued progress in the lighting of Singapore, for particulars of which they refer to the report annexed from their Engineer and Manager, Mr. E. J. Wells, dated Feb. 26, 1879.

The Directors going out of office by rotation are Messrs. Frederick Alexander Malcolm Nicol and Alexander Erskine Stephenson; and these gentlemen, being eligible, offer themselves for re-election. The present Auditors, Messrs. William Thomas Morrison and Alfred Williams, retire from office according to the Articles, and, being eligible, offer themselves for re-election.

The balance-sheet to Dec. 31, 1878, appended to this report, shows the financial position of the Company. The Directors have written off for depreciation of works and plant, and off the expenses of first establishment, as per balance-sheet, at the rate of 1 per cent. per annum. The profit for the half year, after writing off these sums, amounts to £2508 14s. 3d., which, together with £554 12s. 2d., the unappropriated profit of the preceding half year, makes the available balance £3063 6s. 5d. Out of this sum the Directors recommend the declaration of a dividend at the rate of 7½ per cent. per annum, less income-tax, on the preference and original capital; the balance of £750 11s. 10d. to be carried forward to the profit of the succeeding half year. The dividend to be payable on the 20th of May.

Report of Engineer and Manager,

Gas-Works, Singapore, Feb. 26, 1879.

Gentlemen,—By the mail leaving here on the 7th inst., I had the honour to forward to you the statements of accounts, Banker's Voucher, &c., showing the working for the half year ending Dec. 31, 1878. I trust they will reach you safely, and, upon examination, be found correct. The accounts being fully detailed, as usual, it is quite unnecessary for me to go into figures.

You will perceive the increase in the gas-rental has been satisfactory, and I may say has exceeded my expectations. The sales of residual products have also come out very well. The loss by exchange has, however, been heavy, amounting to £909 3s. 4d. on the £4950 remitted, the whole of which has been charged to revenue account.

My opinion is that the loss by exchange for the half year ending June 30, 1879, will be heavier, and it is best to provide for it as it occurs. The average rate for the half year ending Dec. 31, 1878, was 3s. 9¾d. per dollar; the average rate on the £2000 remitted during the present half year has been under 3s. 8¾d. per dollar; the rate for the remittance by this mail being only 3s. 8d. per dollar, and even this was obtained with difficulty.

During the half year, the collection, on the whole, has been satisfactory, 51,582,84 dols. having been collected and paid to the bank.

In the carbonizing department, No. 1 bench of retorts has been reset, and is ready for use. We have now three benches available when required. The retorts *ex Star of the South*, to reset Nos. 6 and 7 benches, have arrived safe and in good condition.

In the purifying department the two new purifiers have been erected and satisfactorily set to work; they will be a great acquisition to the plant, as the Nos. 1 and 2 purifiers have been in use since 1864, and for nearly all that time with oxide of iron. They will require a thorough overhaul, and I have no doubt we shall find that considerable repairs will be required.

The gasholders at present show no signs of decay. All the plant is in good condition.

During the half year the arrangements with the Municipality, under the public lamp contract, have worked satisfactorily, the illuminating power of the gas having been maintained at 15 candles, and kept free from impurities.

During the half year the fitting staff have been fully employed; 32 new houses have been fitted up, the total increase in the number of lights being 640.

(Signed) E. J. Wells, Manager.

Dr.—*Balance-Sheet, Dec.* 31, 1878.

To Capital—		
£5 paid on 2,000 preference shares		£10,000 0 0
£5 „ 10,597 ordinary shares		52,985 0 0
		£62,985 0 0
Debenture bonds		450 0 0
Bills payable		751 19 11
Sundry creditors		581 7 0
Insurance reserve-fund		175 2 6
Profit and loss		3,063 6 5
		£67,986 15 10

Cr.—*Balance-Sheet.*

By Works and plant, to June 30, 1878	£35,754 6 10	
Add extensions this half year	408 18 10	
	£36,163 5 8	
Less depreciation at the rate of 1 per cent. per annum	178 15 6	£35,984 10 2
Amounts charged to capital, for travelling expenses, rent, preliminary expenses, and interest on capital during construction	£10,840 5 11	
Less amount previously written off	1,012 13 3	
	£9,827 12 8	
Less amount written off this half year, at the rate of 1 per cent. per annum	54 0 0	9,773 12 8
		1,118 2 8
Purchase of land		
Cash at Bankers, London and Singapore	£868 4 6	
Ditto in hands of Secretary	3 11 11	
Bills receivable	1,650 0 0	£2,521 16 5
Office furniture		94 14 6
Retort account		1,886 4 9
Meter renewal account		61 2 6
Stock on hand		11,858 15 9
Gas and meter rental, fittings and sundries under collection—		
Amounts due to Dec. 1	£3,560 6 4	
Ditto for the month of December	1,927 10 1	5,487 16 5
		£67,986 15 10

Dr.—*Profit and Loss Account, from July* 1 *to Dec.* 31, 1878.

To Coal carbonized	£2,461 2 7
Lime and oxide	22 2 6
Trade and general charges	412 17 5
Rent, rates, and taxes	124 7 9
Directors and Auditors	210 10 0
Salaries and Collectors commission	769 11 0
Gratuities to officers	302 10 0
Wages	420 14 2
Interest on loans and debentures	71 2 5
Loss on exchange	909 3 4
Bad debts and allowances	84 7 6
Retort account	200 0 0
Meter repairs and renewals	75 0 0
Depreciation on works and plant, and expenses of first establishment written off	232 15 6
Office furniture	10 0 0
Balance—profit for appropriation	3,063 6 5
	£9,379 10 7

Cr.—*Profit and Loss Account.*

By Balance at profit and loss, June 30, 1878	£2,866 10 5	
Less amount declared as dividend, after deducting income-tax on ordinary and preference shares	2,311 18 3	£554 12 2
Gas and meter rental		6,848 10 8
Products, profit on fittings, and sundries		1,975 18 9
		£9,379 10 7

The Chairman said: Gentlemen, I am not generally in the habit of making long speeches at the meetings of this Company, and on the present occasion I certainly shall not depart from my usual practice, because I am suffering from illness. Indeed, I do not think it is necessary that I should do so, because there are only one or two points to which I wish to call your attention. As you see, we still go on paying the monotonous, but not altogether unsatisfactory dividend of 7½ per cent.; for it is by no means unsatisfactory, when you bear in mind that we are able to pay this after having charged our profit and loss account with the large amount of £909 for loss on exchange on the half year's working. Our dividend on the year amounts to a little over £4600, and our loss on exchange this half year has been at the rate of £1800, compared with our dividend of £4600. When you find we can bear a loss like that, and still pay our usual dividend, I think it must appear to you that we are in an eminently satisfactory position. What may happen when the exchange rises to par again I will not venture to prophesy; but, at all events, this is the state of things at present. I shall be very happy to answer any questions that may be put to me by the Shareholders; and with these few observations I will move—"That the report, with the balance-sheet attached thereto, be received, adopted, and entered on the minutes."

Mr. R. S. Foreman seconded the motion, and it was put and carried unanimously.

The Chairman then moved—"That a dividend be declared to the preference and ordinary Shareholders, at the rate of 7½ per cent. per annum, less income-tax in both cases; such dividends to become payable on the 20th of May next."

Mr. Foreman seconded the motion, which was carried.

The retiring Directors—Messrs. F. A. Malcolm Nicol and A. Erskine Stephenson—were then re-elected, and Messrs. W. T. Morrison and A. Williams were re-appointed Auditors of the Company.

The Chairman then moved—"That the best thanks of the Shareholders be given to Mr. E. J. Wells, the Company's Engineer and Manager at Singapore, for his zeal and energy in conducting the affairs of the Company there." It was, he said, almost useless for him to repeat what he had often expressed in that room—namely, the feeling of satisfaction the Directors had at the way in which Mr. Wells managed the Company's business.

Mr. Williams seconded the motion, which was carried unanimously.

Mr. Rice proposed a vote of thanks to the Chairman and Directors, and also to the Local Committee in Singapore, for their services during the past year.

Mr. Williams seconded the motion, which was carried.

The Chairman, on behalf of the Directors and the Local Committee, said he thanked the meeting very much for the compliment that had been paid them. He hoped that in future they would do even better than they had done in the past. At all events, they would endeavour to do the best they could.

Mr. Williams briefly returned thanks for his re-election as Auditor.

Mr. W. T. Morrison also responded, and in doing so proposed a vote of thanks to Mr. King, the Engineer and Secretary. They all knew the interest taken by Mr. King in the affairs of the Singapore Gas Company, and how much he had its prosperity at heart. Whenever occasion required, he invariably answered any questions put to him in connection with the business of the Company, with that intelligence which a gentleman in his position should always show.

Captain Reinecker seconded the motion, which was carried unanimously.

Mr. King having expressed his thanks for the compliment paid him, the proceedings terminated.

SUTTON (SURREY) GAS COMPANY.

The Ordinary Half-Yearly General Meeting of this Company was held last Thursday—Mr. C. E. Amos in the chair.

The Secretary (Mr. Frank Mead) read the following report:—

Your Directors have much pleasure in presenting their report and statement of accounts for the half year ended Dec. 31, 1878.

The increase in the rental, as compared with the corresponding period of 1877, amounts to £318, or about 9 per cent.

A considerable sum has been expended in repairs and renewals; and the works are now capable of meeting a much larger demand for gas than is likely to be made upon them for some years.

The balance-sheet shows a net profit of £1906 12s. 2d., out of which your Directors recommend that a dividend be declared on the paid-up capital of the Company, at the rate of 10 per cent. per annum on the original capital, and 7 per cent. per annum on the additional capital (less income-tax in both cases), and that the balance be carried forward to next account.

Since your Directors last had the pleasure of meeting you, the Company has sustained a serious loss in the lamented death of its old friend, Mr. W. W. Thorn. Mr. Thorn was a Director of the Company for fourteen years, and your Directors desire to place on record their high appreciation of his conduct during the many years he was a member of the Board.

Taking into consideration the favourable position of the Company, your Directors consider the time has arrived when their friends, the gas consumers, should participate in the Company's success, and have decided to make a reduction of 3d. per 1000 cubic feet in the price of gas, the reduction to take effect from the 31st of March last. This will make the net price 4s. 9d. per 1000, to such persons as pay their gas accounts within one month from the date at which they become due.

The Directors who retire by rotation are Mr. J. T. Overton and Mr. M. Jones, who, being eligible, offer themselves for re-election.

One of the Auditors, Mr. B. T. Harding, retires by rotation, but, being eligible, offers himself for re-election.

The following notice of motion was handed in to the Directors at the general meeting, held on Oct. 31 last:—"That at the next meeting a resolution be proposed, that an independent Manager be appointed at a fixed salary."

Dr.—*Revenue Account for the Half-Year ended Dec. 31, 1878.*

To Manufacture of gas—						
Coals, including all expenses			£1518	1	4	
Purifying materials, oil, water, and sundries			56	11	0	
Wages and gratuities			237	18	11	
Repairs and maintenance of works and plant, materials, and labour			541	2	1	
					£2353	13 4
Distribution of gas—						
Repairs and renewals of meters					35	3 8
Repairs and renewals of mains and services					15	0 0
Public lamps—						
Lighting and repairing					104	14 0
Rent, rates, and taxes—						
Rates and taxes					47	4 10
Management—						
Directors allowances			£175	0	0	
Salary of Secretary			57	10	0	
Collector and Clerk			119	2	0	
Stationery and printing			10	0	9	
Auditors			12	0	0	
					373	12 9
General charges					148	1 2
Reconstruction of works					200	0 0
Total expenditure					£3277	9 9
Balance carried to profit and loss account					1555	4 8
					£4832	14 5

Cr.—*Revenue Account.*

By Sale of gas—						
Private rental—12,312,000 cubic feet, at 5s. 6d.			£3385	17	4	
Public rental and under contracts			791	18	0	
			£4177	15	4	
Less discounts allowed			269	1	2	
					£3908	14 2
Rental of meters					77	3 3
Residual products—						
Coke, less labour and cartage			£461	13	0	
Tar, " "			125	12	2	
Ammoniacal liquor			78	8	2	
					£665	13 4
Services					180	11 2
Transfer fees					12	6
					£4832	14 5

The Chairman having moved the adoption of the report,

Mr. C. R. Mead, in seconding the motion, commented on the various satisfactory items the report and balance-sheet contained. Alluding to the two matters which had worked unpleasantly during the past year, Mr. Mead said one of them was the determination of the Inspectors of Public Lighting to reduce the hours of lighting. The Company had, of course, nothing to do with that further than to comply with the Inspectors instructions. The Inspectors had, however, since re-considered the matter, and the lamps were now lighted till one o'clock in the morning. Another unpleasant circumstance was that the Authorities had increased their rating to an extent which the Directors thought unfair. It had been raised to £800.

Mr. Close: Why do you not appeal? The Croydon Company appealed, and obtained a reduction.

Mr. Mead pointed out the difficulties in the way of an appeal, and went on to say that the Carshalton Gas Company, the Water Company, and the Railway Company had been treated in a similar way. It entailed a vast amount of trouble and expense to appeal, and it was a question whether it was worth while contesting the assessment.

The Chairman, in reply to questions by Mr. Cheeswright, stated that the matter of filling the vacancy on the directorate, caused by the death of Mr. Thorn, would come before the Board at a future time, and they would take the legal course. The Shareholders at that meeting had no power in the matter.

The motion for the adoption of the report was then put and carried unanimously.

Mr. Newton then proposed, and Mr. Jones seconded, a proposition to the effect that dividends should be declared in accordance with the Directors recommendations.

The motion was carried unanimously.

Mr. Warren moved, and Mr. Greenhill seconded, the re-election of Mr. J. T. Overton as a Director of the Company, and the resolution was carried unanimously. Mr. Matthew Jones was also unanimously re-elected a Director.

The Chairman said the next business was the motion of which Mr. Steele had given notice, to the effect that an independent Manager be appointed at a fixed salary. They would be very happy to hear Mr. Steele and his opinions on the whole matter.

Mr. Steele then brought forward the motion of which notice was given in the report. In doing so he disclaimed any personal feeling in the matter, but he held an opinion against the present mode of conducting their business. He considered the management of the Company should be conducted by one who was really and entirely responsible to the Board of Directors for what he did. In a concern of that kind, every person should be in his proper place, and fill that place properly. If the Directors were really the representatives of the Shareholders, certain duties and responsibilities devolved upon them, and the Officers of the Company should be paid for what they did. He thought it would look better and more business-like if a paid Manager were appointed. As far as he understood, at present the Company possessed no paid Manager, in the true sense of the term. It was true the duties might be performed, but to his mind this did not appear to be the correct way of doing things. One of the Directors officiated as Manager, and was paid by his co-Directors for his services, thus, he thought, destroying that direct control which the Directors should have over their officials. The Directors should be, like Cæsar's wife, above suspicion; but their present management was—to put it in the mildest way—open to objection. The Manager should be actually under the control of the Directors, and the present Managing Director not being so completely under control as he should wish, he had ventured to bring forward this resolution, which he felt convinced was of vital importance to the Company, and, if adopted, would lead to good results. He concluded by moving—"That a competent Manager be appointed at a fixed salary."

Mr. Hunt seconded the proposition.

Mr. Close questioned the advisability of making any alteration when the Company were doing so well. Nothing could be better than the present condition of the Company, and he could not see why a change should be introduced. If the Shareholders would take his advice, they would let things remain as they were.

The Secretary (Mr. F. Mead), in the course of his remarks in defence of his position and that of the other Directors, combated the statements made in certain circulars which had been sent round to the Shareholders from time to time, and letters published in a contemporary. He went on to say that Mr. Steele had circulated a report to the effect that he was holding an illegal post as Managing Director. He begged to say he did nothing of the kind. It was perfectly competent for the Shareholders to appoint a Managing Director, and remunerate him in any way they thought proper. He received a commission upon the rentals as payment for his work, and that was a system which he had himself introduced, and which he thought satisfactory in all respects. He went on to allude to the resolution which had been carried, that the Directors should receive £350 per annum, and arrange with him (Mr. Mead) as they pleased. He (Mr. Mead) had expected Mr. Steele would have shown the Directors how they could make things better than they were at present. He had, however, simply predicted that his proposed system might be better. Mr. Close expressed a contrary opinion. Therefore, after all, the matter simply resolved itself into a difference of opinion. His (Mr. Mead's) household held something like the ninth part of the shares of the Company.

Mr. Steele: I have a tenth part of the shares.

Mr. Mead remarked that he had a ninth part, and said the Company had to consider whether any change would be for the better. If they considered their affairs would be better for such a Manager as Mr. Steele suggested, they would vote for that gentleman's proposition; if they took a contrary view of the matter, of course they would not. He was, however, quite content to leave the matter in the hands of the Shareholders, many of whom, he knew, shared Mr. Close's opinion, that, as they were doing well, they had better let well alone.

Mr. Rymer, in supporting the motion, alluded to the stake Mr. Steele had in the concern, and expressed his conviction, from his knowledge of Mr. Steele's character, that, in bringing forward his resolution, he was prompted by a desire to benefit the Company. He contended that the affairs of the Company should be conducted in a perfectly straightforward manner, so as to leave not the slightest room for cavil. If there were any irregularities, they should not be allowed to remain.

The Chairman ridiculed the idea that the Directors of the Company were dictated to by Mr. Mead, and dwelt upon the ability which the Managing Director brought to bear upon his work. As long as the present Directors were upon the Board, the same system as that now adopted, which had been so successful, would be carried out. He had no personal feeling in the matter, but only desired that the meeting should look at the matter from a common-sense point of view.

Mr. Steele replied to the arguments which had been used against his proposition. He expressed his surprise at the idea of letting well alone, to which Mr. Close had given expression. He considered the expenses of management were excessive. A competent Manager could be engaged for £100. At Carshalton, the Company used to pay £100, and now paid £120 a year to their Manager.

Mr. Jones: They pay him £200 a year.

The Secretary pointed out that the Carshalton management cost more than that of Sutton.

After some further conversation, the Chairman put Mr. Steele's proposition to the meeting, and it was rejected by a large majority.

On the motion of Mr. Close, seconded by Mr. Warren, £100 was added to the remuneration of the Directors.

A vote of thanks was then passed to the Chairman and Directors, and the former having replied, the proceedings terminated.

The Lancaster Corporation and the Gas Company.—An arrangement has (says the *Preston Guardian*) been come to between the Parliamentary Committee of the Lancaster Corporation and the Directors of the Lancaster Gas Company for the purchase of the gas-works by the Corporation, and the arrangement now remains to be confirmed by the whole Council and the ratepayers. It is understood that the sum agreed upon for recommendation to be paid for the works is something like £80,000, exclusive of about £7000 in mortgage bonds, which will also have to be redeemed. The capital of the Company is £30,000.

ODESSA WATER-WORKS COMPANY, LIMITED.

The Ordinary Half-Yearly General Meeting of this Company was held on Tuesday, the 22nd inst., at the City Terminus Hotel, Cannon Street—Sir Francis S. Head, Bart., in the chair.

The Secretary (Mr. Emanuel Allen) read the advertisement convening the meeting, and the following report of the Directors was taken as read:—

The Directors beg to submit the accounts for the half year ending Dec. 31, 1878.

The result of the year's working is as follows:—

Expenditure.		*Receipts.*	
June 30	£16,711 0 0	June 30	£19,155 0 0
Dec. 31	17,622 0 0	Dec. 31	19,906 0 0
	£34,333 0 0		£39,061 0 0
Balance	10,507 0 0	Add paid by Municipality to make up guarantee for the year to Dec. 31, 1878, allowing £2366 estimated loss on exchange	5,779 0 0
Total	£44,840 0 0	Total	£44,840 0 0

From the above balance, £9098 has to be deducted for interest on the Company's debt, leaving a surplus of only £1409, which the Directors propose to carry forward as before in aid of future dividend upon the A shares.

The expenditure for the past year has been greatly increased by the heavy loss on exchange (which also added considerably to the other general expenditure), and by the high price and bad quality of the coal purchased during the war.

As proposed in their October report, the Directors have made a special representation of the position and grievances of this Company to the Imperial Government, by the despatch of Colonel Keatinge, V.C., an officer who has long held high Indian employment, to St. Petersburg.

Colonel Keatinge was courteously received by the Ministers of the Interior and Finance, but was assured that the Russian Government have now no power to enforce the most ordinary and urgent requirements of health, cleanliness, and civilization in Odessa—matters which in that city seem to be left entirely to the ratepayers.

The approach of the plague may perhaps show the value of those sanitary laws which experience has taught other European countries to enact, and an order is impending to compel all the inhabited houses of Odessa to take the Company's water in the course of the next two years. Still, the town sewers are not only incomplete, but are without even the commencement of a provision for outfall. There is apparently no real belief in the necessity for drainage or cleanliness in a city where they are most especially wanted.

The enormous danger and damage to which the whole trade of South Russia is exposed, by such reckless neglect, is sufficiently obvious. It is to be hoped that the cessation of war may enable the Russian Government to give its attention to a domestic and commercial legislation based upon the practice and experience of this and other civilized countries. The wisdom and necessity of bringing all sanitary arrangements again under Imperial control cannot then be overlooked.

Meanwhile, the improvement of water-rents continues, and the general position of the Company, though extremely bad, is, upon the whole, decidedly better than it has been.

The Directors have appointed Colonel Quill as Manager at Odessa, and have already found his presence there of advantage to the Company.

Two of the Directors—Sir Francis S. Head, Bart., and Robert Barclay, Esq.—retire at this meeting by rotation. They are eligible for re-election, and offer themselves accordingly.

Report of the Resident Engineer.

Colonel A. S. Quill. *Odessa, March* 19, 1879.

Sir,—I have the honour to report that during the six months ending the 31st of December last, the quantity of water pumped into Odessa by the engines at the Dneister station amounted to 508,609,465 gallons, as against 489,121,905 gallons in the corresponding six months of the previous year 1877, showing an increase in the late six months of 19,487,560 gallons.

The total quantity pumped from the Dneister during the year 1878 was 978,495,985 gallons, or an increase of 9,339,000 gallons upon the quantity pumped in the year 1877.

The coal consumed at the Dneister pumping-station during the six months ending Dec. 31, 1878, amounted to 1370 tons, or 2·69 tons per million gallons pumped to Odessa.

With the exception of one burst on the main-pipe line, which occurred upon the 18th of September, there has been no serious accident to the machinery and plant of the Company during the half year, and the supply of water to Odessa was maintained throughout.

The buildings, machinery, and mains of the Company are being maintained in an efficient condition, and, in the absence of unforeseen accident, will require little more than ordinary repairs.

The number of new meters fixed during the past six months was 238, giving a total of meters in work on Dec. 31, 1878, of 2703, and the number of new services connected with the street-mains of the Company, during the same period, was 117.

(Signed) Walter Bradbury, Resident Engineer.

Dr. *Capital Account, for the Half Year ending Dec.* 31, 1878. Cr.

Capital expenditure to June 30, 1878, as per last account	£954,069 4 0	A shares preferred—30,000 shares of £20 each	£600,000 0 0
Less repayment on account of property relinquished	675 13 6	B shares deferred—12,472 shares of £20 each	249,440 0 0
	£953,393 10 6	Debenture bonds, 6 per cent.	143,050 0 0
Balance carried to general balance-sheet	45,903 9 6	Debenture stock, 5 per cent.	6,807 0 0
	£999,297 0 0		£999,297 0 0
Authorized share capital—A shares preferred, 30,000 shares of £20 each	£600,000 0 0		
B shares deferred, 12,500 of £20 each	250,000 0 0		
	£850,000 0 0		

Dr.—*Revenue Account, for the Half Year ending Dec.* 31, 1878.

To Expenditure at Odessa—		
Salaries and wages at Odessa and Dneister	£4,663 15 0	
Coals	3,753 14 1	
Stores, maintenance of works, and general working expenses	1,337 13 7	
Expense of water sales, &c.	403 1 4	
Rents, rates, and taxes	296 10 8	
Office expenses, stationery, fire insurance, &c.	375 3 2	
Travelling expenses	103 9 5	
Law charges	405 9 0	
		£12,145 16 3
To Expenditure in London—		
Directors and Auditors fees	£675 5 0	
Salaries of Secretary and Clerks	390 0 0	
Rents, rates, and taxes	139 17 6	
Law charges	292 19 10	
Miscellaneous charges, printing, and advertising	102 17 10	
		1,602 0 2
		£13,747 16 5
Loss by exchange on salaries and remittances from Odessa		3,874 17 7
Interest on debenture bonds and 5 per cent. debenture stock		4,553 1 4
Balance carried to balance-sheet		3,510 8 9
		£25,686 4 1

Cr.—*Revenue Account.*

By Water-rents	£22,113 7 11	
Less increase in outstanding debts	4,371 14 5	
		£17,741 13 6
Amount paid by Municipality of Odessa to make up guaranteed amount for the year to Dec. 31, 1878, at 7·40 roubles per £1	£8,145 19 6	
Less estimated loss on exchange	2,366 6 6	
		5,779 13 0
Meter-rents		863 17 1
Miscellaneous receipts		1,291 8 0
Transfer fees		9 12 6
		£25,686 4 1

Dr.—*General Balance-Sheet.*

To Sundry outstanding accounts		£493 3 8
Interest accrued on debentures and 5 per cent. debenture stock, and provided for		1,901 9 4
Debenture interest outstanding, including income-tax unpaid		640 4 6
Deferred dividend warrants issued, less portion converted into 5 per cent. debenture stock		8,135 1 11
Capital account, balance at credit thereof		45,903 9 6
Revenue account—		
Balance at credit for half year to June 30, 1878, as per last accounts		4,714 15 9
Balance at credit for half year to Dec. 31, 1878	£3,510 8 9	
Less balance at debit for half year to June 30, 1878	2,101 1 3	
		1,409 7 6
		£63,197 12 2

Cr.—*General Balance-Sheet.*

By Cash at Bankers and in hand, in London and Odessa	£5,235 0 4
Ditto on deposit in London	1,800 0 0
Ditto to meet debenture coupons unpaid	640 4 6
Bills receivable	202 14 2
Remittances in transit	5,000 0 0
Stock of tubes, fittings, &c., at Odessa	32,048 6 0
Stock of coals at Odessa	2,374 17 9
Office furniture and leases in London and Odessa	1,833 10 9
Sundry debtors	1,839 7 4
The Municipality of Odessa in respect of guarantee to Dec. 31, 1878	5,779 13 0
Expenditure in suspense, as per last accounts	6,423 18 4
	£63,197 12 2

The Chairman, in moving the adoption of the report, said that in the capital account there was a small item of £675, repayment on account of property relinquished. That was a return on an advance payment made on a building which they found they did not require, and on which they would receive a further small payment of about £1000. In the revenue account they would observe that there was a large amount put down for increase in outstandings. That, however, was simply owing to increased rents. Their rents were collected after the close of the year. They were made up to the 31st of December, and were not collected immediately, and there being an increased amount of rent, it involved an increase of outstandings, but they would probably recover most of it. He saw miscellaneous receipts entered in addition to meter-rents, and this arose from various little profits on work done by the Company. He did not see anything else in the accounts different from what had previously appeared, and he would therefore proceed to deal with the report. They would see that, while the receipts had increased to £39,000, as against £31,000 in the previous year, the expenditure had also increased to £34,333, as against £28,544 in the preceding year, being an apparent increase of expenditure of £5789. That looked bad, but it was very easily explained. It arose almost entirely on three items—the increase of £3745 upon the loss by exchange in excess of that of the preceding year. The total loss by exchange last year was £5744, being, as he had said, an increase of £3745. That was a matter as to which the Directors could not be held responsible. The next large item was that of coal, the increase in the cost of which over the the preceding year was £3756, consequent on the war, and, therefore, unavoidable as far as the Directors were concerned. The salaries also showed an increase of £782, which was entirely attributable to the depreciation of the rouble. If they gave a man a certain salary at Odessa, and paid him in roubles, which became of less value, the man expected, and, in fact, must have, an increased pay to compensate him. These items altogether came to £8063, for which, as he had said, the Board could not be held responsible. There had been some saving in other respects, which had diminished the actual increase of expenditure to £5789. As to coal, that was a matter which they might think was within the discretion of the Directors, but he would tell them how they stood in regard to it. Their old stock of English coal lasted till the end of 1877, when the war was going on. In the meantime, they could not wait till the last day before their coal was exhausted. They therefore had to make arrangements previously, and they had to buy Silesian coal, which was neither so good nor so cheap as English coal. They bought 1266 tons, perhaps, up to November, and again 180 tons in February last year, making 1446 tons of Silesian coal. After that they arranged to send out coal from England, and in March they were able to arrange for that; but, unfortunately, the steamers conveying the first cargo which was despatched, broke down, and they were obliged to buy 400 tons of Merthyr Tydfil coal at Odessa, to go on with meanwhile. For that 400 tons they had to pay 44s. 6d. per ton. Those items increased the cost of coal to the extent he had mentioned. This carried them on till the end of July last, after which time their own English coal came into use. Since then they had continued to use that coal, which was at a considerably lower figure, and of better quality. Therefore this loss was entirely temporary, owing to the war, and was quite unavoidable. The next paragraph in the report referred to the despatch of Colonel Keatinge, an officer of considerable reputation in India, to St. Petersburg. He now held the important post of Chief Commissioner of Assam. He was at home for a time, and as he had had considerable experience, he was selected by them as being the best person they could obtain to go to St. Petersburg and make those representations which he (the Chairman) explained, at the last meeting of the Company, that the Directors intended to make to the Russian Government. He had already told them that they had been under considerable obligations to Count Schouvaloff, as well as to M. Bartholomei, of the Russian Embassy, for their kindness and courtesy; and on this occasion Count Schouvaloff wrote specially to the Minister of the Interior, and asked him to give particular attention to the instructions of Colonel Keatinge; and accordingly that gentleman was received with every courtesy. The Minister of the Interior received from him a memorandum of what they wanted done, which chiefly consisted of the list of requirements to which he had before referred, and that list of requirements the Minister had translated into Russian. He then duly considered it, but the result, after consultation, was what was described in the report—that they came to the conclusion that the Russian Government now had no power to enforce the most ordinary requirements of health and cleanliness in the city of Odessa. The Shareholders might say to the Directors, "You might have known that before;" but they did not. He was not sorry that this mission had taken place, because they now knew who was responsible. They were told that the Corporation and the Ratepayers of Odessa were solely and entirely responsible for the existing state of things in that city. He would inform them what the sanitary condition of Odessa was at the present time; but he must premise that they had a great object in improving it, as a proper supply of water, which was necessary for the health of the inhabitants, meant to the Company a very large addition indeed to their receipts. Therefore, apart from any philanthropic interest which they might take in the matter, the success of the Company depended almost entirely on the completion of the sewers, and the carrying out of that system of sanitary arrangements which was found necessary in all other countries, but which, at the present moment, did not exist in Odessa. Partly in consequence of the mission of Colonel Keatinge, and partly

on account of the plague, the Governor, General Heintze, called a meeting of the ratepayers of Odessa in February, and delivered to them a long address on this subject. Without troubling the meeting with the whole of it, he would just say that General Heintze unmistakeably admitted the very defective condition, and the general unhealthiness of Odessa, and recommended strongly to the inhabitants that reform was urgently required, both on account of the danger they incurred from the plague, as well as for the general health of the country. General Heintze pointed out that Odessa was in constant danger of infection from the plague, from its proximity to Constantinople, and he also gave those general considerations which applied to any civilized city. One of his remarks was this: "Although I have only been a short time in Odessa, I can point out houses belonging to wealthy people where the cesspools have not been cleaned out for 40 years." That was the Governor of Odessa's own testimony. Then he went on to explain the great danger they ran from the plague and other epidemics, and concluded by saying: "If we can get the town into a healthy condition, in the full sense of the word, there will be no ground for fear of epidemics. In its present state, we must always fear epidemics coming from Turkey." That was very important, because General Heintze, from the position he holds, was not the man who would wantonly call out "stinking fish." But his (the Chairman's) attention having been attracted to the matter, he had made considerable inquiries as to what was the real state of Odessa. He could not give his authorities, because gentlemen connected with Odessa did not wish their names given; but the Shareholders might rely on their accuracy, and on their competency to form the opinions they expressed. One gentleman explained what was perfectly true—that, exteriorly, Odessa was a very clean place; the streets were well paved, and each inhabitant was bound to keep clean the front of his house in those streets, and this law was enforced where the streets were paved. But in the unpaved streets and in the suburbs the case was different, and the mud and dust lay nearly a foot deep. Odessa was built on a very porous soil, and any filth or dirt which was not cleared away sank into it, and it became like a sponge, perfectly saturated with filth and pestilential matter. That, as his informants explained in detail, had taken place most completely in Odessa; and although the outside of the houses in that city looked clean, the moment people went below the surface, they found one complete saturation of sewage. At that moment there were 27 miles of sewers. They commenced constructing them, but then they began to see that they would have to pay for the water used in flushing them; and they stopped short. These sewers were therefore "blind"—there was no outlet; and they were filled with filth, and, therefore, instead of being a benefit to the town, they were a source of pestilence. His informant told him that it was difficult to find out what the death-rate of Odessa was, but it was known to be very high, and typhus fever and diphtheria were constant and deadly, in addition to other preventible disorders. Another gentleman who visited Odessa some time ago, and who was particularly well qualified to judge, described the condition of the place in language which he (the Chairman) really hardly liked to read to them—the details given were positively too bad to read. He wound up by stating that there was no reason which he could see why the people of Odessa should have a system of sewers and an ample water supply, and yet studiously neglect the use of the one and the proper working of the other. It had been explained to him (the Chairman) that there were 27 miles of sewers, and there were besides 40 miles of streets and 14 miles of other streets, making altogether 54 miles, which required sewers; so that he might say there were already constructed sewers sufficient for half the streets, if they only gave them an outlet, and used them. He was reminded—and it was perfectly true—that when this enterprise was first planned, the chief inducement to undertake it was not only the immediate requirements of the inhabitants of Odessa for water for washing and drinking, but for flushing and using these sewers, and that upon that the whole enterprise was based. He would go further and say that he was not at all certain that if we had a Court of Equity in England they could not claim damages for the non-completion of these sewers. He would conclude his observations on this point by reading a letter from their friend Mr. Frere (their former Engineer), who had just returned from a tour abroad, and who happened a few days ago to see their report. He was in their service for two years in Odessa. In his letter he referred to the incomplete state of the sewers there, which he described as elongated cesspools, and he stated that since the laying of the Company's pipes the water level had been raised, and many of the cellars were flooded, and full of sewage. Mr. Frere went on to state that "if the plague, or any such epidemic disease, should once obtain a footing in Odessa, the city would receive a blow which it would take many years to recover from." He (the Chairman) was very glad to have had the opportunity of laying before them these details, and he only hoped that what he had said as to the real condition of Odessa would reach Russia, for the authorities there would not hear of it from their own people. It was the third city in the Russian empire, and such a state of things, instead of being left untouched by the Government, and referred to the Municipality, who quietly and coolly proposed to do nothing, he could not help thinking ought to receive the attention and consideration of that great Government. He had referred to General Heintze's address. He was a very gallant and well-known Russian soldier, and a most estimable person; but, of course, he was not a scientific man, and his idea of dealing with the plague was simply to enforce the most rigorous quarantine, and to take what he (the Chairman) might call military measures against any one who might be affected. He had written to a gentleman who was considered one of the most scientific men in his profession in England. He had forwarded to that gentleman General Heintze's address, and, in reply, he stated that competent persons had laid it down that the plague was not communicable from person to person, but that the poison was conveyed. Now, Oddessa was a locality which received and developed the poison, but when the conditions for its development were absent, its development was disturbed; and where there was cleanliness, a proper water supply, and perfect sewers, the plague was impossible, but at present the soil of Odessa was saturated with sewage. If any plague reached there, it would affect the whole of the trade of the Black Sea. He hoped sincerely that the plague would not reach there, but, if it did, he ventured to say that it would not be long before they had to complete their sewers. The report stated that "an order is impending to compel all the inhabited houses of Odessa to take the Company's water in the course of the next two years." That was talked of as a great measure, and they were assured of this at the time of issuing the report; but since then they had received the order which was issued. He might first state that there were about 3000 houses taking water from them, more or less, and there were 2000 more that did not take it, besides others in the suburbs. They depended on getting water where they could. Since the report was circulated, an edict had been issued, the gist of which was contained in article 3, which only required the yards within the town boundaries to be supplied with water from the Company's works within a period of two years, so they left everything else as before. These yards were to have a stand-pipe, from which the people were to take water to drink, and perhaps to wash their faces with. It was known that where there was a stand-pipe, the occupier and owner of the house not only took it, but made a profit out of it, by charging his lodger for every pint of water the latter used. This edict was intended to stop that. It also prohibited any solid sewage going into the sewers. It had to be put by, then collected, and then it was taken to the railway and conveyed by rail "somewhere." This was the state of things in a city with 200,000 inhabitants, where there was an abundant water supply, with half of the sewers already constructed! And what was it for? Simply to save the increased water-rate which would have to be paid for the water which would be required for washing out these sewers. He need not tell them, and he ought not to have to tell the inhabitants of Odessa, that if they were to go into the matter they would find, seeing the expenses necessarily incurred by the existing system, and taking into consideration the dangers from the plague and other epidemics, that it would be a good deal cheaper in the end to take the water. The effect of the regulations which had been issued was not to increase the consumption of water, but to take every possible means of preventing it. The existing state of things was most unsatisfactory, but it was too bad to last. At the present moment a state of martial law had been proclaimed, and he confessed that he read with very considerable satisfaction the statement that General Todleben had been appointed Governor-General of Odessa, for he was not only a gallant but a scientific soldier, and he could not but think that when General Todleben saw the condition of Odessa for want of common precautions, he would exercise an influence which he (the Chairman) thought must be beneficial to the Company. The Shareholders would see, from what he had said, that the evils from which they were suffering were extremely troublesome to deal with, but that they depended on matters and causes as to which they could only do what they were doing—make their grievances known. These matters were beyond the control of the Board, and they must hope that the results of peace, and the inconvenience, damage, and danger of the existing condition of things would bring about a remedy. Meantime, as stated in the report, the general position of the Company, though bad, was decidedly better than it had been. He did not think he could be accused of ever having been over-sanguine, therefore when he told them that he thought things looked better, he hoped they would understand that he had grounds for saying so. The improvement in the water-rents—from £30,599 to £35,726—was to the extent of about 15 per cent. in the past year. That did not altogether include the whole of the receipts due to them, because they had an unusual amount of outstandings, and they had £5000 owing to them by the troops. Colonel Keatinge stated this to the Minister of the Interior, who replied that it was impossible; but he (the Chairman) begged to endorse Colonel Keatinge's statement, and to affirm that such was the fact—that a sum of 51,000 roubles was owing for the troops. In addition to that, there was owing to them by the hospitals £800, which ought to be paid. If they put these different things together, they would see that the Company were receiving a good deal more for water, although nothing like the amount they ought to be receiving. Then they had been able to discharge the loan of £10,000 due to their Bankers. Three of the Directors—Sir Arthur Clay, Mr. Barclay, and Mr. Wigan—gave their personal security for that loan, and, owing to this act, they had been enabled to carry on their business. The Zemstro tax was remitted some time ago, in consequence of their representations, and they were informed that the considerable arrears for the tax would not be enforced. As to the claim of Mr. Schwaben for £70,000, he had not said much about it, as the matter was *sub judice;* but although the question was not yet quite settled, he might say it now amounted to this—not what the Company owed Mr. Schwaben, but what Mr. Schwaben owed them. The item "Expenditure in suspense," £6423, was one of the claims they had against Mr. Schwaben. They would have gathered, from what he had said, that the two great grievances under which they were now suffering were the conduct of the Municipality and the inhabitants of Odessa, in not taking ordinary measures to enforce cleanliness and health, and the depreciation of the rouble. By the latter cause they lost £5744 last year, as he had already stated; but that did not express the whole of the loss, for by the increase in the salaries, owing to the same cause, the loss was really over £6000. That, of course, was a material point; but every gentleman present could gauge what prospect there was of an improvement in that respect. He himself believed that the Russian Government must, sooner or later, take steps to restore the rouble to something like its real valve; but it was a point on which they might fairly look with some hope, as they did on the conduct of the Municipality. A number of debentures had fallen due in the past three months; £20,500 fell due this April, and in their condition of struggling against the difficulties he had referred to, they had some anxiety as to their renewal. They had, however, for the present, surmounted the difficulty, partly by the assistance of the Directors, and partly by the assistance of one or two of the Shareholders, who came forward and took the debentures, and partly by a considerable portion of the debentures being renewed by those who held them. He felt sure that none of those parties would regret the course they had taken in this matter. Next year they had some £15,800 of debentures falling due, and the following year a large sum, and he could only hope that those who were largely interested in the Company would be good enough to assist the Board in getting those debentures renewed. Individually he held £5000 worth of the debentures, so he thought he was doing his share. He then referred to the appointment of Colonel Quill as Manager at Odessa, and expressed satisfaction at his appointment.

Sir ARTHUR CLAY, Bart., having seconded the motion,

A discussion ensued, in which Messrs. Stewart, Baynes, Captain Nelson, Mr. Keat, Mr. Northover, Mr. Michell, and other gentlemen, took part; but the nature of their questions and observations is sufficiently indicated by the reply of

The CHAIRMAN, who stated that Colonel Quill had been appointed at a salary at present of £800 a year and quarters, and the engagement was at three months notice on either side. They were very satisfied with the appointment. Many of the applicants for the position, who replied to the Company's advertisement, were altogether unsuited for it, and they considered themselves most fortunate in securing the services of Colonel Quill, who had been holding a very important appointment on the Staff in Canada. As to the law expenses in Odessa, such was the state of things there that they must in many cases either go to law, or forego the rates to which they were entitled. He should be very happy to see them reduced, but it was the only recourse they had; they could not cut off the water, as in this country. He considered that the law charges in London were excessively moderate; they consisted almost entirely of the charges consequent on their lawsuit with Mr. Schwaben, and, considering the position of that suit, he thought this money had been well spent. He had explained the causes through which the expenses had increased, and those causes were clearly beyond the control of the Directors. The difference in the payments by the Municipality was that the Municipality had to make up the deficiency of the rouble. Mr. Michell ought to have known that the guarantee was due after the accounts were made up at the end of the year. They had received the deficiency, and there was no payment now till next year, and the smaller the deficiency the better. As to the question of Directors fees, he had answered it very often. He could only say that he would not undertake the responsibilities and the duties of Chairman of this Company without being paid. If the Company paid a dividend, the labours of the Directors would not be any-

thing like they were at present. He would for his own part rather give up his fees when they could pay a dividend, because if they were in that position, then he would be receiving some return on his shares. They had no liability, and nothing to do with their late Manager.

The motion for the adoption of the report was then put and carried unanimously.

Sir ARTHUR CLAY then moved, and Mr. DINGWALL seconded, the re-election of Sir Francis Head, and the motion was carried unanimously.

The CHAIRMAN expressed his acknowledgments for the confidence thus shown in him, and his obligations to his colleagues for their support and assistance. He then moved the re-election of Mr. Barclay.

Mr. NORTHOVER seconded the motion, and it was carried unanimously.

A vote of thanks to the Chairman and Directors was then passed, and, in reply,

The CHAIRMAN said they were much obliged for the renewed proof of the Shareholders confidence, and they would do what they could to deserve it.

The proceedings then terminated.

FYLDE WATER-WORKS COMPANY.

The Twenty-ninth Half-Yearly Meeting of this Company was held on Monday, the 21st inst., at the Offices, Kirkham—Mr. H. L. BIRLEY in the chair—when the following report of the Directors was presented:—

Capital Account: The expenditure on capital account has been increased during the last half year by £3534 3s. 3d., and now amounts to £176,970 12s. 1d.

Revenue Account: The amount received during the half year ending Feb. 28, 1879, was £6935 6s. 11d.; less interest on loans and commission, £973 9s. 11d., and working expenses, £2101 15s. 10d.—£3075 5s. 9d.; leaving a balance of £3860 1s. 2d.

There has been an increase of £950 9s. 4d. in the receipts for water for the year ending February, 1879, beyond that of the previous year. The houses supplied are greater in number by 459, amounting to 6779.

Your Directors have taken care to protect the interest of the Company as regards the Thirlmere water scheme, and have had clauses for this purpose introduced into the Bill now before Parliament.

The Directors recommend a dividend at the rate of 5 per cent. per annum, free of income-tax; and that the balance, after making such payment, of about £500, be carried to the reserve-fund.

The Barnacre reservoirs are completed, and have about 18 feet of water in them, the full depth being about 22 feet. They appear, so far, quite satisfactory. Very little has been done at Grizedale since the last meeting. No definite conclusion having been come to, your Directors last November called in the assistance of Mr. Hawksley and Mr. Garlick, to advise with Mr. Foster and the Directors before any further large expenditure is incurred.

The total expenditure under the head of the "Grizedale reservoir and extraordinary repairs and extra water supply account" now amounts to £15,464 4s. 10d., of which £10,643 3s. 1d. has been expended in the attempt to repair the bank, and £4821 1s. 9d. for the extra water supply.

The retiring Directors are Mr. E. Birley, Mr. C. Birley, Mr. Clifton, and Mr. Myres; and the retiring Auditor, Mr. Hulley.

The CHAIRMAN, in moving that the report and statement of accounts be adopted, said that, on referring to the statement of accounts, it would be seen that the capital account had been increased by £3534 during the past six months. Of this sum, £2774 had been spent on the new works at Barnacre, and £754 on the mains. The expenses during the half year had been, in addition to the amounts mentioned, about £414, which had been caused by one or two little matters. There had also been a considerable expenditure in consequence of the severity of the weather, as they had to repair different portions of the pipes damaged by the frost. Those were extra items which, in all probability, would not occur again. There had been spent on the Grizedale reservoir during the past six months £840, and on the pumps £203, and they had paid £850 for water. There was available for dividend £3860, which would allow of a dividend of 5 per cent., and there would then be a balance in hand. The Barnacre reservoir was in a satisfactory state. The Engineers report on the condition of the Grizedale reservoir was only received on the previous Saturday, and, therefore, the Directors had not had time to consider it. They thought it desirable to call in extra assistance, to ascertain the real condition of that reservoir, and Mr. Hawksley, Mr. Garlick, Mr. Jackson, and Mr. Foster had been directed to make an inspection, and their report was as follows:—

Fylde Water-Works, Preston, April 9, 1879.

Gentlemen,—We have the honour to report that we have this day made a further examination of the works of the Grizedale reservoir, with the object of ascertaining the causes of the leakage through the embankment, and of suggesting the adoption of such measures as will, in our judgment, be likely to effect a reasonable, if not a complete remedy.

Firstly, we find that water escapes through the concrete wall of the main trench, through numerous small passages at the junction of one layer of concrete with another layer, in consequence of the edges and layers adjacent not having been perfectly united at the time the work was performed, and we attribute this want of union to the removal of the cement from amongst the stony materials of the concrete by the wash of water entering the trench and passing over the unset or imperfectly set concrete on its way to the pumps. Everywhere, except at these horizontal lines of junction, the concrete is solid, sound, and water-tight, and has attained to a very remarkable degree of solidity and hardness.

Secondly, some attempts have been made to cut out the injured portions of the concrete, and to replace them with other materials. So far as this operation has been performed, it appears to have been attended with success; at all events, under the pressure of water, about 30 feet, to which the renewed concrete has as yet been subjected.

Thirdly, we agree in opinion that this operation should be persevered in till all the ascertained apertures in the concrete wall have been effectually stopped under the existing reservoir; that then an additional supply of about 10 or 15 feet of water be admitted into the reservoir, when, if other escapes be found to exist, these may be similarly plugged, and that finally the drift ways and sumps, made for the purpose of inspection and access, be securely fitted with concrete of the best quality and workmanship.

Fourthly, we think that in view of the possibility of other injury from floods, these and the other unfinished works of the reservoir should be completed with as much despatch as the peculiar circumstances of the case will permit.

Fifthly, in conclusion, we beg to remind you of a former recommendation, for the removal of the defective puddle at the south end of the trench, and its proper replacement, partly with concrete and partly with clay puddle, as the case may be found to require.

We are, yours, &c.,

T. HAWKSLEY, JOS. JACKSON,
EDWD. GARLICK, W. S. FOSTER.

P.S.—We are of opinion that the works of réparation are not of such a definite character as to enable us to submit a reliable estimate of the expenses.

Mr. T. FAIR, in seconding the resolution, said the Directors regretted the unsatisfactory condition of the Grizedale reservoir. It was the only dark side of the Company, which otherwise would have been a flourishing one. When they looked at the report, they would notice that the increase in the receipts had been close upon £1000. They had had some difficulty with Grizedale, but he hoped that would be surmounted. He had visited the water-works, and he could assure them that the Barnacre reservoir had very strong banks, and was nearly full, which would relieve the Company of paying for additional water.

Mr. PEERS asked if the Barnacre reservoir was of sufficient magnitude to enable the Company to supply their customers until the Grizedale reservoir was repaired.

The CHAIRMAN said, with reference to the supply of water for the coming season, he thought there would be sufficient in the reservoirs to meet the requirements of the district by purchasing compensation water, which would cost about £225. In answer to another question, he said that the Barnacre reservoir would hold 195 million gallons, and that the daily consumption in the district was 900,000 gallons.

Mr. SHARPLES said he wished to mention a matter which had caused the Company much anxiety. In the Engineers report, the loss of water at Grizedale was stated to be caused by leakage, and he wished to know whether that was so or not. Some members considered that the damage was caused by springs.

The CHAIRMAN said the Engineers seemed to think that the leakage was caused through the defective concrete. The Barnacre reservoir was paid for, except a small account with the contractor. Something like £10,643 had been spent on the repair of the Grizedale reservoir.

Mr. BRADLEY said the cost of the Grizedale reservoir would be between £40,000 and £50,000, and he considered it was a miserable failure.

The CHAIRMAN said the Directors had taken care of the interests of the Shareholders, and had spent as little money as possible. Since the last meeting the Engineers had followed the source of the leak by means of a tunnel.

Mr. E. BIRLEY thought it would be clearly seen that the Directors were as much alive to the position of the Company as the Shareholders. They felt that some six months ago a large expenditure had been incurred in endeavouring to discover the leak at the Grizedale reservoir, and they thought it desirable, both in the interests of the Directors and the Shareholders, that Engineers should be called in. With the consent of the Directors, Mr. Foster called in Mr. Hawksley, Mr. Garlick, and Mr. Jackson. Although the expenditure was large, up to the last half-yearly meeting, the Directors were satisfied that it would be reckless on their part if they authorized the continued large expenditure until the cause of the leakage was found out. They had that morning received the report which had been read, and they had scarcely, as the Chairman remarked, had time to give it their consideration.

The motion was then carried unanimously.

The CHAIRMAN proposed that a dividend at the rate of 5 per cent. on the £134,662 be paid.

This was carried, and the retiring Directors—Messrs. E. Birley, C. Birley, and Clifton—were re-elected, Mr. Bradley being elected in the place of Mr. Myres, who did not seek re-election.

The usual votes of thanks closed the meeting.

LECTURE AT HULL ON ARTIFICIAL LIGHTING.

On Tuesday evening last, Mr. C. COPLAND, M. Inst. C.E., late Superintendent and Engineer to the British Gaslight Company at Hull, delivered a lecture on "Artificial Lighting" in the Royal Institution of that town, before the Hull Literary and Philosophical Society. Mr. R. M. CRAVEN (the Sheriff) presided.

Mr. COPLAND first brought under the notice of the audience the various methods and appliances for securing artificial light, remarking that the consideration of the best materials and apparatus for securing pure, cheap, and steady means of lighting was a subject of the greatest interest to all classes of the community. The inventor who could perfect a system which would improve the quality and cheapen the cost of the means of illumination would be a benefactor to his race, and it was not too much to say that but for artificial light the progress of civilization would not have been so rapid as it had been during the present generation. He then briefly noticed the progress of means of lighting from the earliest ages of mankind, from the period when the blazing faggot from the camp fire would be the readiest and most required, incidentally alluding to the shell-lamp, the lamp in use amongst the earlier races of India, those found in the ruins of Pompeii and the tombs of the Egyptians, as furnishing specimens of these vessels in metal and clay, which were similar, he said, to those in use in Italy at the present day for burning olive oil. If, he said, any person wished to know with what kind of illuminators our great-grandfathers went about in the dark, let him examine Hogarth's pictures in the National Gallery. Speaking of the manufacture and use of candles, on which head he gave some curious and interesting statistics, he said prior to 1832 candles were taxed, and the poor were compelled to dip their own rushes. But thanks to the enterprise and ingenuity of certain manufacturers of the present day, the poor had now greater illumination and brilliancy in their dwellings than the nobility of a hundred years ago. Oil-lamps, he observed, were not introduced in the streets of London until the reign of Charles II., and then they were only lighted from Michaelmas to Lady-day, and even then only from dark to midnight. Very little progress was made in lamps until two Frenchmen introduced their inventions, and Argand's arrangement became the adopted system. With these exceptions, nothing was done until the latter part of the 18th century, our ancestors being satisfied with a lamp which was practically a liquid candle; and from that time until the present, so far as regarded burning vegetable oil for domestic purposes, there had been only one advance upon the liquid candle, in the shape of a small circular burner, which had been described as invented by Argand.

As illustrating the manufacture of various qualities and descriptions of candles in use at the present time, Mr. Copland drew attention to the operations of one of the largest concerns in the kingdom, which employed 1300 hands, and consumed 25,000 tons of coal. The enormous production of this one factory should, he thought, prove a strong argument against any unreasonable panic such as last year arose among gas shareholders, in consequence of the electric light, which, in his belief, should it ever become a commercial success, would have a field of its own without damaging gas or other light-producing agents.

Next, at very great length, Mr. Copland spoke of the discovery and application of common coal gas, and reviewed the history of its struggles, promising that previous to the commencement of the seventeenth century the most vague conjectures existed as to any aëriform body, and probably they were suggested by the mysterious and sudden deaths which occurred in subterranean and other enclosed spaces. At the present time the gas interests at home and abroad represented a little over £300,000,000. He alluded to Sugg's experiments with the Argand burner, and said that, having personally inspected the system of lighting in London as arranged by Mr. Sugg, he considered it a great success, both as to cost and illuminating power, in comparison with the electric light. The lamps which had been placed outside the building would give the audience a fair idea of the difference between the present street lighting and the new system. He had to thank his friend Mr. Runton (Chairman of the Sutton and Southcoates Gas Company) for putting up those lamps. There was also in the room one of the lamps, which gave a very pleasant and soft light even there. Speaking of the Argand burner of Mr. Sugg, Mr. Copland said it produced a far steadier light with common gas than any other form. It had not been so generally used for internal lighting until Mr. Sugg apportioned its parts, and supplied it with a delicate self-regulating apparatus. The lecturer then described with some amplitude the various gas-burners and their qualities, the process of the manufacture of coal gas, the difficulties in the way of supplying it pure, the delicate operations on which the lighting of a town depended, the relative illuminating power of gas supplied in different large towns, and gave some practical hints and suggestions as to the economical consumption of gas.

Having also explained several forms of gas illuminants, Mr. Copland passed on to an explanation of the different electric light inventions, and, to the great regret of the audience, he had to abandon nearly the

whole of his carefully-prepared paper in reference to the new system of lighting. In consequence, too, of the inability of the makers to supply him with the necessary machinery, he was unable to show the action of the electrical engine. He succeeded, however, in making several interesting and beautiful experiments.

In conclusion, he said: Much nonsense has been written and spoken respecting the disuse of gas which would follow the introduction of electricity. The same was said of oil and candles when gas was introduced; yet more of both these illuminants than ever are now used. The consumption of gas, instead of lessening, will probably receive an additional stimulus from the use of gas-heated boilers, gas-engines, gas-cooking stoves, and the use of gas for heating apartments. The brilliant effect of large spaces lighted by the electric light causes the present dimly-lighted streets to look dark by comparison. A higher standard of gas will be called for, and shopkeepers and others, who are unable to adopt electricity, will do their best to keep up an appearance, beside their more fortunate neighbours, by an extra consumption of the older illuminant. There is nothing at present, in the advance made by the electric light, to interfere with the use of gas in private houses, the supply of which is by far the most profitable source of revenue to a gas company, the receipts for the public lamps, both in London and the provinces, being rarely more than 5 per cent. of their annual rental. That electricity will be adopted, wherever possible, and where the cost of it is not an object, there is little doubt, it being specially adapted for the illumination of large open spaces, workshops, spinning-mills, contractors works, docks, railway stations, and for naval, military, and lighthouse purposes. It will enable building operations to be carried on by night as well as by day, and the farmer may continue harvesting without stopping at sundown, if the crop is wanted to be gathered in quickly, which in this uncertain climate must be a great boon to him. The electric light dawns upon us in an age of science and invention; thousands of busy hands and ingenious brains are ready at once to seize upon it and develop its latent power. Gas, as a sort of illuminating power, had its birth when the world was not as it is now; science was less advanced, and men of great technical skill were few. There is a tendency to run in grooves, and although the modes of manufacture and supply in respect of gas have undergone great improvements, I believe that it has not yet received due honour even from its best friends. A closer acquaintance is necessary between the gas companies and the consumers. It will no longer answer the companies purpose to send gas along the mains for the consumer to burn according to his own ignorance. The shifts and stratagems by which the consumer seeks to get light out of gas, while burning as little as possible, have the effect of damaging both parties. Just as the householder has wholesome water pouring into his tank or cistern, and foul water running out of it, so the gas consumer has 16-candle gas passing through his meter, and something like 10-candle gas being consumed at his burners. Cannot the gas companies help him? I think they might, or, rather, I think they must. The use of gas requires to be popularized. There is no need to make gas of higher illuminating power than 16 or 20 candles, but this quality should be supplied at a lower price, in a state of greater purity, and with more effective pressure. The Sculcoates Gas Act, 1875, limits the sulphur compounds to 30 grains per 100 cubic feet; ammonia, 5 grains per 100 cubic feet. The last six months give—sulphur, 27·83 grains, mean; ammonia, 0·47 grain, mean. In London, a general amalgamation of gas companies is taking place, and I believe it is the opinion of persons who are well able to judge, that the present moderate price will soon be brought lower. The gas companies have weapons at their command, if they will but use them. These weapons are enterprise, science, and economy. In my opinion, our authorities in Hull would do great public service by promoting such a condition of affairs in this town as that existing in the Metropolis, as the separate supply by three different companies is not a system likely to secure a supply of this great necessary of our daily life in the cheapest and most equitable manner. The electric light has yet many difficulties to conquer, which will require an enormous amount of energy and resource. It is comparatively easy to kindle a great light, and dazzle the eyes of the multitude, and the latter hardly care at present what the light costs, or whether it can be made available for common use. The large proportion of actinic rays in the spectrum of the electric light, which is closely allied to that of the sun, makes it an invaluable agent to the photographer, both for taking portraits and for printing operations, and many of the London and Parisian artists have been so using it for some time past. If the electric light is hermetically enclosed in a glass vessel, absolute safety is ensured, and will be found especially valuable for submarine purposes, and for lighting the galleries of coal mines, and for manufactories producing explosive compounds which can now only be carried on during the hours of daylight. There is every reason to expect that great improvements will yet be made in the present practice of electric lighting. If machines, worked by engines, could be dispensed with altogether, and a simple battery be found which would be free from the drawbacks hitherto inseparable from their use, great results would follow, the foremost being the introduction of the light into private houses, though I think there would then be still as much diversity of opinion as now exists amongst the public as to the value and effect of gas, oil, petroleum, and candles. The electric light, if used without shades, must always be a cold, searching, and peculiar illuminant, only pleasing to a certain portion of the community. Nevertheless, should it remain in the same state as at present, the wholesome stir it it has made throughout the world will, in all probability, be conducive to still greater improvements in the quality and price of coal gas. Indeed, if its only result were the perfection which Mr. Sugg had attained by his improvement in the Argand burner, both for street and house illumination, the general public would have good reason to be thankful.

Mr. Preece, of the London Postal Telegraph Department, spoke of the able and exhaustive manner in which Mr. Copland had treated the subject of his lecture. It should have been extended to a series of three lectures. The result of his (Mr. Preece's) studies had been to completely confirm Mr. Copland's view as to electricity having a field of its own—that it did not in any shape or form interfere with the function of gas. He proposed a vote of thanks to Mr. Copland for his lecture.

Mr. W. T. Dibb seconded the motion, regretting that the large amount of interesting matter which Mr. Copland had prepared for their edification had not, for want of time, been touched. He hoped that that portion referring to electricity would form the subject of a future lecture.

The motion was carried with acclamation.

CARBURETTING AIR.

The following letter, signed "William Lyon," addressed to the Editor of *Engineering*, appeared in the last number of that periodical:—

Sir,—The cost required to produce the electric light is not easily obtained, but enough is at present known to condemn it as too expensive for commercial use. But the cost of carburetted air or gas is indisputably confirmed by practical experiment. Therefore, I beg to submit the constant value of carburetted air or gas, with gasoline, at the market price per gallon.

Practical Test.—Bar. 29·8, temp. 56 deg.; the weight of gasoline 655 grains to water 1000 grains. Therefore, one gallon of gasoline = 45,850 grains. I simply aspirated 1 cubic foot of air at the rate of 6 cubic feet per hour through an ordinary chemist's wash-bottle containing 1000 septems of gasoline, the tube maintained at 3-inch seal in the liquid. The cubic foot of air took up 735 grains. I also recharged the bottle and repeated the experiment on 1 cubic foot of 17·10-candle gas, which took up 585 grains.

Therefore, 1000 cubic feet of air will absorb 735,000 grains of gasoline, and 1000 cubic feet of gas will absorb 585,000 grains of gasoline.

Grains.

1000 cub. ft. of air = $\frac{735,000}{45,850}$ = 16·0 galls. of gasoline per 1000 cub. ft. of air.

1 gall. of gasoline =

1000 c. ft. 17·10 gas = $\frac{585,000}{45,850}$ = 12·7 galls. of gasoline per 1000 cub. ft. of gas.

1 gall. of gasoline =

1000 cub. ft. of air after being carburetted = 1320 cub. ft., and 1000 cub. ft. of 17·10 gas after being carburetted = 1270 cub. ft.

Specific Gravity Test.—The time required to pass equal volumes of air, gas, carburetted gas, and carburetted air, under equal pressure, through the same aperture (Schilling's test).

Air, 88 secs.; gas, 58 secs.; carburetted gas, 90 secs.; carburetted air, 104 secs.

Gas . . . . . $\frac{58_2}{88_2}$ = 0·434 to air 1·000.

Carburetted gas . $\frac{90_2}{88_2}$ = 1·045 to air 1·000.

Carburetted air . $\frac{104_2}{88_2}$ = 1·396 to air 1·000.

Photometric Test.—Test on Hartley's improved photometer, 15-hole Argand-burner (old standard), 7 inch × 2 inch chimney, consuming 2·04 cubic feet per hour of carburetted gas = 14·59 standard candles, reduced to the standard of 5·00 cubic feet = 35·78 standard candles.

Also with No. 1 steatite bat's-wing, consuming 2·40 cubic feet per hour = 18·63 standard candles, reduced to the standard of 5·00 cubic feet = 38·83 standard candles.

3·48 cubic feet per hour of carburetted air consumed through Argand burner = 16·52 candles, reduced to the standard of 5·00 cubic feet = 23·70 candles.

Durability Test.—The durability of 1·10 cubic foot, 4-inch flame.

	Min.	Sec.
Gas	5	45
Carburetted gas	16	38
„ air	11	24

I have experimented on various forms of carburators—viz., cylinders containing lamp-cotton, sponge, felt, and wood carbon. They are all useless and obstructive, nor do they yield so high or regular a light as air aspirated or exhausted through gasoline, and charged into a gasholder, from which it is supplied ready for use at the burner when required. If 1 cubic foot of air takes up and retains at the normal pressure 735 grains, the gas will be quite costly enough, without adopting other artificial means, which, if they do not add to the cost of the oil, most certainly add to the cost of carbonizing. Air costs nothing, and nearly every coal gas-making establishment large enough to afford an exhauster may connect a vessel on the wash-bottle principle to the inlet of exhauster, and keep it as a carburator charged with gasoline. They may then fill their holders with air gas of the best quality, and supply it as they do coal gas. These facts ought to be known, because the price of oil only, compared with the price per ton of coal, will govern the time when present gas producers may supply the one or the other.

The gasoline I made the above experiments with cost 2s. per gallon. Therefore, 16 gallons at 2s. = 32s. for 1320 cubic feet of air gas = 23·70 standard candles. And 25s. for raising 1270 cubic feet of 17·10-candle gas to that of 38·83 standard candles.

DIOPTRIC APPARATUS IN LIGHTHOUSES FOR THE ELECTRIC LIGHT.

At the Meeting of the Institution of Civil Engineers last Tuesday, a paper on the above subject was read by Mr. James T. Chance, A.I.C.E.

The author briefly premised that in the Fresnel or dioptric system, the source of light occupied the central position within a structure of glass zones, or annular segments, by which the incident rays were condensed and directed on the sea; and that there were two principal kinds of dioptric apparatus, the fixed and the revolving. He then proceeded to make some observations concerning the different optical treatment which a small radiant like the electric arc required from that which suited an ordinary flame. In the latter case, as far as it concerned sea-lights, the object was not only to parallelize all the rays emanating from any point of the luminary, but also to reduce the vertical divergence due to the height of the flame by increasing the diameter of the optical instrument. On the other hand, the smallness of the electric arc afforded the opportunity of obtaining from the dioptric zones or other elements, by suitable generating sections, whatever divergence, whether horizontal or vertical, might be desired. It was also pointed out that the source of light, in the case of the electric arc, could not be entirely depended upon for maintaining the same position in relation to the focal horizontal plane; and that consequently, since the vertical divergence due to the luminary would move upwards or downwards with any vertical displacement of the radiant itself, the mariner could not be absolutely secured from failing to see the light, unless a special vertical divergence were given by the dioptric apparatus, independently of that caused by the size of the electric arc. This, however, involved the adoption for this illuminant of a dioptric instrument considerably larger than what was original contemplated, so as to reduce materially the luminary divergence, and thereby be free to substitute it, to some extent, a special vertical divergence.

The author stated that in 1862 he had expressed himself in favour of a much larger apparatus than was then employed with the electric light at Dungeness. Also that in 1865, Messrs. D. and T. Stevenson had recommended a third-order apparatus for the purpose, in their report to the Commissioners of Northern Lighthouses. A similar result was arrived at by the Elder Brethren of the Trinity House in 1869, in consequence of comparative trials instituted by Professor Tyndall, for testing the relative merits of a sixth-order light and a third-order one respectively, when used with the electric radiant.

The Souter Point Revolving Light, which was first exhibited in January, 1871, was described. Reasons were assigned for adopting two optical agents—one to condense the light in the vertical plane, the other to produce the required horizontal compression—instead of attempting, even for the refracting part of the apparatus, to effect the two condensations respectively by a single agent. Reference was made to the proposal of Mr. Thomas Stevenson, M. Inst. C.E., for attaining this latter desideratum; as likewise to that of Mr. Brebner, M. Inst., C.E., with a similar object. The method actually adopted was similar to that which had been already employed in France for the revolving light with the electric arc. It con-

sisted of a fixed third-order light encircling 180°, and of a rotating octagonal drum of the same height surrounding it. Each side of this drum, comprising three panels in height, was composed of vertical refracting prisms, by which the light, radiating in azimuth from the inner fixed apparatus, was compressed horizontally into a beam of 7° 8′ divergence in addition to that due to the diameter of the electric arc. This was done in such a manner that every single prism had its own independent divergence of the same amplitude, whereby was obtained an extent of light-emitting surface of a height of 6½ feet and of 22½ inches in breadth. Stress was laid upon its being the characteristic feature of the beam issuing from any one of the sides of this glass drum that, in passing before the eye of the observer at sea, its brilliancy would, from first to last, remain unchanged, as distinguished from the waxing and waning appearance of the ordinary revolving light; consequently, at whatever distance the flash might be visible, the interval of its duration would be the same. Attention was also directed to the valuable suggestions made by Mr. J. N. Douglass, M. Inst. C.E., the Engineer to the Trinity House, that advantage should be taken of the landward hemisphere of the radiant light of the electric arc, to provide a beam which should be made to issue through a window in the tower below the main light, in order to mark certain dangers in Sunderland Bay; and it was stated that 54·6 per cent. of the rearward hemisphere of light had been thus utilized.

The two fixed lights which were inaugurated at the South Foreland in January, 1872, were described. It was explained how the whole of the catadioptric zones—both upper and lower—were in both lights made to parallelize the rays in the usual manner. The light, however, incident on the refracting portion of each light was distributed over the sea from the horizon to within a short distance from each tower, by a succession of increasing angles of vertical divergence, so that the illumination of the sea became gradually diminished as the distance from land was lessened. In each light there was a rearward arc to spare, and this was turned to valuable account, from 67 to 71 per cent. of this light being collected and acted upon by optical agents, which were particularly described, and thereby distributed uniformly over the front azimuthal arc, so as to intensify not only the illumination of the horizon and the distant sea, but also that of the nearer sea.

It was mentioned that the two Lizard lights, which were both fixed, and were first exhibited in March, 1878, had optical arrangements similar in every respect to those adopted at the South Foreland Lighthouses, with a slight variation in the refracting portions, arising from the circumstance that existing apparatus had to be turned to account in the construction of each apparatus.

A table was appended, showing the condensing powers in the direction of the horizon of the lights described in the paper, distinguishing those optical portions which parallelized the incident light from those which gave to it special vertical divergence. According to this table, upon the assumption that the diameter of the electric arc was 12 millimètres, the condensing powers in the sea-horizon direction were as follow:—

Souter Point—revolving	236·38
South Foreland—high fixed	50·17
South Foreland—low fixed	43·40
Two Lizard lights—fixed	58·44

And data were added for adapting this table to particular cases.

In a second table was given the respective condensing powers over the near sea, at different distances from the lighthouse towers.

THE LANCASHIRE COAL AND IRON TRADES.

(FROM OUR OWN CORRESPONDENT.)

It is only in very exceptional cases where there is anything like activity in the coal trade of this district, there being generally but a very indifferent demand for all descriptions of fuel, and very few of the collieries are running full time—some of them not more than seven or eight days to the fortnight. The demand for house-fire classes of fuel is now small, and, although the gas coal trade is beginning to move, there are not any very large number of inquiries in the market; and in the few instances where contracts have been already made, I hear of very low prices having been taken. The demand from works for fuel for iron-making and general manufacturing purposes continues very limited, and slack is still accumulating in stock at many of the collieries. Prices, with the exception of some of the best seams of Lancashire house coal, are extremely low, and, if there is not so much underselling in the market, it is simply because values have touched a point below which it is almost impossible to go. There is, however, a great deal of irregularity in the selling prices, and, so far as quotations are concerned, it is only the average that can be given. Best Wigan Arley is fetching about 9s. to 9s. 6d. per ton at the pit mouth, good ordinary qualities, 8s. to 8s. 6d., and inferior sorts, for house-fire and gas purposes, 6s. 6d. to 7s. 6d. per ton; Pemberton four-feet, 6s. 6d. to 7s. 3d.; ordinary Wigan mines, 5s. 6d. to 6s.; steam and forge coal, 3s. 9d. to 4s. 3d.; and good slack, 2s. 9d. to 3s. 3d.; with common sorts ranging from 2s. per ton and upwards.

The coke trade continues very quiet, there being no improvement whatever in the demand for this class of fuel, and the greater portion of the ovens in this district have been out for some time past. Large cokes at the ovens are quoted at from 15s. to 18s. per ton, and small cokes about 12s. per ton.

The iron market here has been somewhat unsettled by the sudden advance in north country iron, as a consequence of the Durham strike, but the higher prices which Middlesbrough makers are asking are not being obtained here, and, in fact, Lancashire makers are offering at even lower figures than ever, without materially increasing their sale, the output from the very few furnaces in blast being still more than sufficient to meet the demand. For Lancashire pig iron delivered into Manchester, 46s. per ton for No. 3 foundry, and 45s. for No. 4 forge are quoted, but less money would be taken for good orders. The manufactured iron trade shows no signs of improvement, and prices are quite as low as ever, the average quotations for Lancashire bars, delivered into the Manchester district, being about £5 10s. to £5 15s. per ton.

THE COAL AND GENERAL TRADE OF THE NORTH OF ENGLAND.

(FROM OUR OWN CORRESPONDENT.)

The general strike in the mining districts has caused a complete suspension of the Durham gas coal trade. As soon as the stocks were wrought off at the collieries there were no more coals to go away. The few gas coals that were shipped at the Tyne Dock were from the Mickley and some other pits in the west of Northumberland, and for these something like 10s. per ton had been paid. The shipments, however, have been of the most trifling description compared with the enormous production of the Durham gas collieries when they are at full work. Some half-dozen steamers have been round to Hull, shipping Yorkshire gas coals, on account of Newcastle merchants, for the Italian ports, the prices being from 9s. to 9s. 6d. per ton. A few sailing vessels have also loaded gas coals at Hull for the London trade. During last week the pitmen occupied themselves in holding mass meetings, and listening to speeches from their leaders. A vote was taken on Thursday, and by an overwhelming majority it was determined that men who were at full work at the old rates should be requested to give in their notices, and that everything should be closed until the end of the strike. It had been suspected, however, in well-informed quarters, that the masters were not quite so united as the men—that there was a danger, indeed, of a break-off. This was realized on Thursday, when it was published that Messrs. Bell Brothers, the great ironmasters and coalowners, had agreed with their men to adopt open arbitration for the settlement of the dispute. The executive of the Union advised the men to accept the terms, and resume work. This was done. They further announced that the pitmen were perfectly agreeable to deal with other groups of collieries belonging to firms under a similar arrangement, and go to work. As the Durham colliery owners had to meet the representatives from the enginemen at Newcastle on Saturday, most people there were very sanguine, that, as the whole matter in dispute between them and the miners on strike was 2½ per cent., both being disposed to allow the residue to go to arbitration, some means would be adopted to re-open negotiations with the men to try to put an end to strife. There was great disappointment, therefore, in Newcastle, Durham, and the district, when it was known that having arranged with the enginemen the owners broke up without any result having been arrived at with regard to the large and more important question of the strike of the miners. People believe that the hindrance was simply "dignity." It is notorious that many owners are most anxious to enter upon a path of conciliation, and would do so were they not overruled by the majority. The collieries not belonging to the Masters Union, except the pits of Messrs. Bell Brothers, which have accepted open arbitration, are not of comparatively large production. They are small pits. Next Friday, if the strike goes on, men whose notices have expired will have come out of the few collieries that are now working upon the old rates. When the strike commenced, some of the larger coal proprietors had heavy stocks of coals on hand. The largest holders would be Sir George Elliott, M.P., and the Earl of Durham. These coals were mostly of value for manufacturing purposes. The heaps have been brought down. Very considerable sums of money have been thus realized quite unexpectedly. There were few, if any, stocks of gas coals heaped. Gas coals need to be sent away fresh.

More than 20,000 tons of coals a week are wrought by the gas collieries of North Durham when they are at work. As the collieries are all practically stopped, an idea may be formed of the effect of the strike upon the gas trade, provided it went much beyond this week. I have reason to believe that the leading coalowners in the gas trade were rather averse to the somewhat *brusque* treatment of the pitmen's delegates, which has hardened the strike in the district to one of the bitterest struggles we have had since 1844. To all present appearance, the colliers have made up their minds to fight things out to the end. Of course, there will be abundance of misery amongst the families if affairs go much further. It is quite impossible to say what may happen during the week; but, writing this on Monday morning, it is pretty clear one cannot see the end of the struggle approaching. At the same time, everything may be changed in a day. It is evident that a strong effort will be made by parties in the North this week, who are not in the quarrel, but who have a great interest in bringing about a settlement, to try and hit upon some scheme to bring about peaceful councils.

The general manufacturing business of the district may be disposed of in few words. The chemical business is dull. There have been better shipments and increased demand for fire-bricks and fire-clay goods. The price of lead is lower. The iron trade is quiet.

(BY TELEGRAPH.)

NEWCASTLE, *Monday Night.*

There are poor prospects of an early settlement of the Durham dispute. I have seen the principal gas coal fitters on 'Change to-day, and they are of opinion that it will be a fortnight at least before the pits get to work. At the same time, if some person of influence were to step in, a compromise might be effected earlier. The belief here is that prices will go up, as gas companies will have to replenish their stocks. Some of the coking collieries are likely to break off.

TRADE NOTES FROM SCOTLAND.

(FROM OUR OWN CORRESPONDENT.)

The anticipations formed regarding the seventh annual meeting of the West of Scotland Gas Managers Association, which was held at Coatbridge on Friday last, were fully realized; for it was certainly a great success. There was a much larger attendance than at any previous meeting, either half-yearly or annual general meeting. The President, Mr. Samuel Stewart, of the Corporation Gas-Works, Greenock, occupied the chair, and he was supported by many well-known Managers throughout the West of Scotland, the towns represented being Glasgow, Paisley, Ayr, Dumbarton, Port-Glasgow, Kilmarnock, Coatbridge, Airdrie, Lanark, Helensburgh, Stirling, Falkirk, &c. From the financial statement submitted, it was shown that the funds of the Association were in a prosperous condition. Mr. Robert Mitchell, Coatbridge, was elected President of the Association, in succession to Mr. Stewart; Mr. R. S. Carlow, on resigning the Secretaryship, was elected Vice-President, while Mr. Dalziel, Kilmarnock, was chosen as his successor; and Mr. William Smith, Helensburgh, was re-elected Treasurer. As extra-ordinary members, there were elected Mr. Henry Walker, coalmaster, Bathgate, and Mr. James C. Adamson, gas engineer, Airdrie; and as ordinary members there were elected Mr. David Fisher, Blantyre, and Mr. David Stevenson, Maryhill. A very comprehensive and instructive address was delivered by the retiring President, for which, on the motion of Mr. Monk, past President, a very hearty vote of thanks was accorded to Mr. Stewart. A keen discussion was raised by a paper on "Analysis of Gas Coal," read by Mr. Andrew Scott, Falkirk, who made very pointed reference to the great disparity shown in the analyses of gas coals made practically in the gas-works, and those published by coalmasters on the authority of professional analysts, and made in the laboratory on a small scale. The general opinion expressed, however, was that the professional analysts reports were only to be taken as guides in making contracts, and that an allowance of from 10 to 20 or even 25 per cent. should be made by gas managers. It might be the case, as Mr. Scott showed, that sometimes the practical analysis in the gas-works fell short of the published analysis by even 2000 or 3000 cubic feet of gas, and that the illuminating power was rarely up to what was alleged by coalmasters when offering their coals; but it would be unfair of gas directors to expect their managers to get out such results as the published analyses showed. The author of the paper is quite a young man, but from the professional training which he has had, coupled with the great ability which he showed in his paper, something further may be expected of him which will redound to his credit. The remainder of the proceedings were both interesting and varied, but as a full account of them will be given in due course, I need not enlarge upon it. It may be mentioned, however, that it was resolved, on the motion of Mr. M'Gilchrist, to hold the next half-yearly meeting in September, at Bridge of Allan; and that the question of amalgamation with the North British Association of Gas Managers was brought up for consideration in an informal way, by a letter from Mr. Smith, of Aberdeen, the new President of that body. At

the termination of the proceedings the members visited the new works of the Coatbridge Gas Company, in company with Mr. Mitchell and several of the Directors. The inspection of their works, their arrangements, and the labour-saving appliances, excited a great degree of interest. In the spacious and handsome retort-house the Directors had laid out a liberal supply of light refreshment, which was partaken of, and in connection with which two or three toasts suitable to the occasion were proposed and responded to. At the dinner which was subsequently held at Clark's Hotel, about sixty gentlemen sat down, under the chairmanship of Mr. Stewart, and the vice-chairmanship of the President Elect. Altogether the Coatbridge meeting will long be remembered by a large proportion of the Association's membership.

At last there is being made in Glasgow a public display of the capabilities of Mr. Sugg's new system of street lighting by coal gas in the "London" Argand burners. On Thursday night a lamp enclosing a 200-light burner was brought into use for the first time in St. Vincent Place, where it abuts on Buchanan Street, in the very centre of the city. With the necessary modifications which had been made in it, the light given out was said to be equal to 360 standard candles, and the consumption of gas was 40 cubic feet per hour. Arrangements are being made to have similar lamps put up at other prominent points, such as St. Enoch Square, George Square, Charing Cross, &c. One of Mr. Sugg's lanterns with a 100-light Argand burner is now in use in Dundee, opposite the post office in Albert Square. I understand that Edinburgh is now moving in the same direction.

It is probable that something further will soon be heard regarding Mr. G. R. Hislop's process for revivifying spent gas-lime, which has now become a very marked success. By means of it, the patentee is able to do much valuable service to soap manufacturers, in the way of treating their so-called soap waste, as well as to gas companies and corporations. There is an intention on the part of the Committee of the West of Scotland Association of Gas Managers to have the process carefully tested and reported upon officially in time for the next meeting.

The Glasgow Corporation Gas Committee, having resolved to close the works belonging to the Commissioners at Partick, have commenced to lay a 2-feet main-pipe between the suburban burgh and the Dawsholm Gas-Works, Maryhill. There will be somewhere about 800 tons of such pipes required for the main in question, the contract for which is now being executed. When the main is completed it will supply the west-end of Glasgow, and a large portion of Partick, Whiteinch, &c.

Some changes have lately taken place in the value of gas and water stocks and annuities, but the only one calling for special mention is a decline in the 6¼ per cent. Glasgow Corporation Gas Annuities, from £157 10s. to £156, last Friday.

The Glasgow pig iron warrant market has been very much agitated during the past week, large speculative purchases having been made in anticipation of the Durham miners strike curtailing the production of pig iron in the Cleveland district. At the close on Friday the prices were—43s. 3d. one month, and 43s. 1d. cash for sellers, buyers offering 1d. per ton less. As high as 44s. 6d. cash was paid on Wednesday.

No new feature has yet shown itself in the Glasgow coal market, and again a limited business is reported from all quarters. The business passing for export orders does not come up to the average of former years.

Cranleigh Gas Company.—The second annual report of the Directors of this Company states that the net profit to the end of December amounted to £180 11s., and a dividend of 3½ per cent. is recommended. At the annual meeting, the report was adopted, and Messrs. Napper and Sherger, the retiring Directors, were re-elected. The Directors have recently reduced the price of gas 6d. per 1000 feet.

Explosion of Gas at Derby.—Last Wednesday an explosion of gas occurred in the engine-house connected with the extensive gas-works of the Midland Railway Company at Derby. It appears that several men were engaged in changing the purifiers, when by some means the gas ignited and an explosion followed, which lifted the roof, shattered the walls, demolished the stationary engine, blew out the windows of the Gas Engineer's office, and scattered bricks in all directions. The men made a timely retreat, and, beyond a few burns, escaped without injury.

Explosion at the Blackburn Gas-Works.—On the morning of the 19th inst., about six o'clock, an accident occurred to a man, named James Carlyle, employed at the Blackburn Gas-Works. At the time stated, Carlyle entered one of the boilers, through the man-hole at the top. Inside the boiler was a gas-burner, from which there must have been an escape of gas during the night, as on Carlyle striking a light, an explosion immediately followed. A workman, hearing the report, went inside the boiler, and found Carlyle so badly injured, that it was necessary to convey him to the Infirmary.

Uckfield Gas Company.—The twenty-first annual report of the Directors of this Company states that, notwithstanding the reduction in the price of gas to consumers, which took effect at Michaelmas last, the receipts for gas had steadily increased, £914 15s. 7d. having been received this year, against £852 10s. 4d. in the previous year. Coke and tar receipts were also in excess of last year, £140 17s. 1½d. having been received against £119 2s. 9d. The Directors have discharged the balance of the debenture loan, amounting to £200 and interest. The assets and liabilities account shows a balance of £672 4s. 11d. available for dividend and reserve. The Directors propose to pay a dividend of 10 per cent. on the capital of £2000, and to retain the balance of £472 4s. 11d. to provide coals and to form a reserve. They also propose to make a further reduction in the price of gas, from 6s. 3d. to 5s. 10d. per 1000 feet, to take effect from Michaelmas next.

Bursting of a Water-Main in Dublin.—On the night of the 18th inst. the portion of the Vartry main-pipe that passes through D'Olier Street burst. Just before eleven o'clock the water-gauges at Leeson Street Bridge, which are kept constantly watched day and night, indicated that a fracture had taken place. Mr. Harty, the Assistant Engineer to the Corporation, who was present at the time, at once gave directions to turn off the water. The burst occurred at a part of the main a short distance from the corner of Fleet Street, not many yards from the place where a similar accident happened about nine months ago. The pipe lies midway between the tram rails, at a depth of about 10 feet from the level of the street, and some yards of the granite pavement immediately above the break were raised several inches, while many of the paving-stones were quite displaced, the water spouting up to a considerable height. It then continued to flow over, flooding D'Olier Street, and pouring into the cellars of the adjacent houses. Fleet Street, the level of part of which is somewhat lower than D'Olier Street, was covered to a depth of six inches with water, which could not be carried off with sufficient rapidity by the sewers, and, consequently, poured in torrents into the areas of the houses. Traffic in D'Olier Street was, of course, stopped until the flood subsided at about half-past eleven o'clock. Mr. Harty and the foreman (Mr. Currie) remained until two o'clock superintending the railing in of the portion of the roadway that was torn up. The extent of the damage done to the pipe could not be accurately ascertained, but it was thought that the necessary repairs might be effected in a few days.

Register of New Patents.

4156.—Hart, A. H., and Potter, J. J., Birmingham, "*Improvements in valves for liquid, steam, and gas pipes.*" Patent dated Nov. 7, 1877.

This invention consists of improvements in valves for liquid, steam, and gas pipes, by which the parts of the valve are so arranged that the whole of the working parts are capable of being withdrawn from the pipe without disturbing the pipe or the case or body of the valve. The valve, when fully opened, gives a passage of the same capacity as the pipe to which it is attached, and the valve is held, by the working or actuating mechanism, very firmly to its seat in the pipe.

In constructing valves according to this invention, the valve proper, or diaphragm, and the mechanism by which the valve is opened and closed, are arranged in a case or body, the body or case being closed by a cover. In the cover a stuffing-box or packing is situated, through which a spindle passes. On the bottom of this spindle is a worm or screw, the teeth or threads of which gear with the teeth of a toothed quadrant or sector. To the toothed quadrant the valve proper is rigidly connected, or the toothed quadrant and valve may be cast in one piece.

When the spindle of the valve is turned by a handle or hand wheel external to the valve-case, the worm or screw on the bottom of the spindle gives motion to the toothed quadrant, and to the valve connected with it, and the valve is moved through the required angle.

On moving the valve into a horizontal position, or parallel to the axis of the pipe, the valve is lifted from the valve-seat in the pipe, and the pipe opened, and the liquid, steam, or gas passes freely through it. When the valve is moved through a quadrant, or nearly a quadrant, it takes a vertical or inclined position, and seats itself against the seat in the pipe, closes the pipe, and cuts off the passage of liquid, steam, or gas through it.

By the removal of the cover of the valve-case, the valve proper and the whole of the valve mechanism may be removed for repair or alteration, without interfering with the pipe or the valve case or body.

4217.—Nawrocki, G. W. von, Berlin, "*Improvements in meters for measuring liquids.*" A communication. Patent dated Nov. 10, 1877.

The object of this invention is to construct apparatus for measuring off fluids in definite quantities, instead of using ordinary standard measures, thus saving much time and space, and affording greater cleanliness. The invention is based upon the fact that no liquid flows out of a syphon, or that the flow will be interrupted, when air is introduced at the bend of the syphon, and is as follows:—

A cylinder is provided capable of holding any suitable undefined quantity of liquid; it is fitted with gauge glass and scale. A pipe leads from the bottom of the cylinder to a two-way cock on a measuring vessel, placed below the cylinder, and gauged to contain a certain measure. A pipe leads from the two-way cock into the measuring vessel from below, rising to a syphon bend, the bottom aperture of which is closed to the bottom of the measuring vessel. At the knee or bend of the syphon a fine bent air-pipe is inserted, so that it can be turned and set from without by means of a lever. The air-pipe has a saucer-shaped washer, which can turn against a washer with a ground surface on the syphon bend. A socket spanner fits on a square on the air-pipe, and passes out through a stuffing-box in the wall of the measuring vessel, being fitted with a spiral spring for ensuring a gentle pressure of the spanner against the air-pipe. The lever is connected by a joint to the spanner, and serves to regulate the desired quantity of liquid. There is also an air inlet and outlet pipe at the highest part of the measuring vessel. It is outside the latter, provided with an enlarged glass cylinder containing a light ball, say, of cork or hollow metal, so as to float in the liquid, and it passes along the supply cylinder containing the liquid, and is open at the top.

The action of the apparatus is as follows:—The two-way cock being closed, the liquid flows from the supply cylinder through the pipe and cock, and the syphon pipe, filling the measuring vessel, rising into the small air-pipe, floating the ball-float in part of same, and causing it to close and prevent further egress of the liquid. The measuring vessel is now filled with the exact quantity of liquid required. If, now the cock is opened, the communication between the supply vessel and the measuring vessel is interrupted, then the whole contents of the latter would run out by way of the syphon. By adjustment of the lever, and consequently of the small air-pipe, the quantity of liquid escaping can be regulated, as according to the elevation of the air-pipe over the bottom of the measuring vessel the syphon draws air sooner or later, and the flow is interrupted.

There is a scale with slots for resting the lever in, according to the quantity desired to be measured. This scale may be of metal, and is fastened to the stand, enclosing the measuring vessel. By closing the cock the latter fills automatically. A plum-bob, suspended from the side of the supply vessel, serves to place the apparatus in level.

4222.—Bangs, D. E., and Burnett, W., Boston, Massachusetts, "*Improvements in carburetters.*" Patent dated Nov. 12, 1877.

The object of this invention is—first, to devise means for replenishing the carburetting-tank without loss of gas or admission thereto of air; secondly, to provide means for determining the quantity of hydrocarbon oil in the carburetter; thirdly, to provide means whereby the delivery of oils to the carburetter may be automatically attained; and, finally, to improve the apparatus generally.

[The apparatus is not described apart from the drawings.]

4249.—Newton, H. E., Chancery Lane, London, "*Improvements in gas regulators.*" A communication. Patent dated Nov. 13, 1877.

This invention relates to that class of gas regulators in which the regulating valve is operated by the pressure of gas under a small and a large inverted cup, both attached directly to the valve-rod, the bottom edge of the said cups being immersed in mercury contained in annular grooves. It consists partly in providing such a gas regulator with a conduit perforated at several points to obtain a distributed discharge of the incoming gas under the large inverted cup, and thereby to equalize the pressure all round the same, and so obviate a twisting or tipping movement of the cup, and a consequent considerable increase of friction and loss of efficiency. It also consists in a novel and simple construction of, and mode of applying guides for guiding the upper and lower parts of the stem or rod to which the regulating-valve and the inverted cups are secured, whereby the said stem is made to work with very little friction.

4252.—Vaughan, E. P. H., F.C.S., Chancery Lane, London, "*Improvements in the production of combustible gases, and in the construction and arrangement of apparatus to be employed therefor.*" A communication. Patent dated Nov. 14, 1877.

This invention relates to certain improvements in the production of combustible gases capable of being applied to various useful heating purposes, and in the construction and arrangement of apparatus to be employed therefor.

The apparatus consists mainly of two separate parts, one being the "extractor," in which the gases contained in the substance or substances treated therein are evolved and expelled therefrom, and the other being the "converter," in which the solid substance remaining in the extractor

after treatment is brought into contact with atmospheric air, and converted into oxide of carbon. The two gases are then mixed and burned together with atmospheric air in order to produce heat.

The extractor is a hollow cylindrical receptacle, one or more of which is or are placed horizontally either above, at the side, or beneath the place in which the gases are to be utilized. The extractors are made of cast iron, fire-clay, or any other suitable material, and are respectively in connection, at one end thereof, with a hopper and screw, or any other suitable mechanical contrivance, by which the fuel, such as coal, peat, sawdust, or other carbonaceous material or materials suitable for the purpose is or are pressed in and moved onwards; whilst the other end is open to afford an outlet for the gases which are evolved from the fuel whilst in a heated state, and also for the removal of the solid substance which remains after the gas has been expelled. If fuel is used which swells or increases in bulk when it arrives at a red heat in the extractor, the latter must be of larger dimensions, or of a wider or conical form, from this point, as otherwise the feeding screw will not be able to force the coked fuel onwards. The screw or other contrivance is turned or actuated by mechanical power, either continuously or intermittently.

The extractors are heated by waste heat, which is obtained from puddling, melting, or other furnaces for the heating of which the apparatus is used, and which waste heat passes through channels provided for that purpose, and which surround the extractors. The gases contained in the fuel are evolved therefrom by the operation of the waste heat communicated to the extractors as before mentioned. As the screw or other contrivance closes the front end of the extractor, the gases are forced to pass over the mass of red-hot solid carbonaceous substance or substances towards the other end of the extractor. The gases capable of decomposition, steam, and carbonic acid, are there decomposed, and converted into hydrogen and oxide of carbon. The tar which is produced during the process of expelling the gases does not leave the extractor, as it is decomposed by the red-hot carbonaceous substance or substances. The gases which are produced, such as hydrogen, carburetted hydrogen, and oxide of carbon, are heated, when expelled at the open end of the extractor, to about an equal temperature to that of the waste heat which has been employed.

When an even unvarying temperature is required, the waste heat is first used to heat the atmospheric air, which is employed to burn the gases, as before mentioned, and in that case an air-heating apparatus is fixed in or behind the said air channels. By actuating the screw, or other mechanical contrivance, the fuel is pushed on in the extractor; as the extracting process goes on, a continuous or intermittent but always regular movement of the fuel is obtained, by which the formation of large pieces of coke is prevented. The solid substance which remains in the extractor after the separation and evolution of the gases, as before described, is pushed forward by the screw or other mechanical contrivance, and finally falls into the converter.

The converter is constructed of any suitable material, and is so arranged as to admit air at the lower part thereof, either through a grate or in any other suitable manner. The air coming in contact with the red-hot carbonaceous matter, oxide of carbon and carbonic acid are produced therefrom. The latter gas is converted into oxide of carbon by passing through the upper layers of the red-hot carbonaceous material. According to the velocity with which the fuel is pushed on in the extractor, the converter can be kept more or less filled.

In order that the slag from the cinders may melt at a low temperature, a corresponding amount of suitable ingredients, calculated to act as a flux, may be mixed with the fuel as it enters through the hopper, and is forced forwards by the screw.

If powdered carbonate of lime be employed, the latter will be converted in the extractor into quicklime and carbonic acid, which latter again will be converted into oxide of carbon, whilst the quicklime finds its way with the solid residues into the converter, in the lower part of which the ashes only of the fuel previously used remain (the solid carbon being oxidized), and forming with the quicklime, or other flux employed, a slag which melts at a low temperature.

The gases emanating from the extractor, such as hydrogen and carburetted hydrogen, will unite with those from the converter, the latter consisting of oxide of carbon and nitrogen from the atmospheric air, and the mixture of the two kinds of gases thus evolved consists of hydrogen, carburetted hydrogen, oxide of carbon, and nitrogen. The mixture of gases from the extractor and the converter enters into a channel provided for that purpose, the temperature of the gases at the entrance of the channel being very high, and corresponding with that derived by the extractors from the waste heat and from conversion of the carbon into oxide of carbon.

The gases having been generated, as before described, are then passed through a suitable channel, in which they are mixed with air, and burned for heating, puddling, and other furnaces, or are burnt for any other heating purposes to which they are applicable. The atmospheric air, previously to being mixed with the gases to burn the same, is passed through suitable channels, which are heated by waste heat.

Small apertures, covered by glass, mica, or any other suitable transparent substance, are provided, for observing the progress of the process in the extractors and convertors. Small valves are also employed for regulating the supply of atmospheric air to the channel.

4269.—Stewart, A. and C., Glasgow, N.B., "*Improvements in cocks and taps.*" Provisional protection only obtained. Dated Nov. 15, 1877.

This invention, which relates to improvements in cocks and taps used for supplying water or liquids in dwelling-houses, buildings, or other situations, wherein a supply of water or liquids is required, has reference, under one modification, to that class of cocks and taps wherein communication with the main or service-pipe is cut off or established by moving the exit-pipe or nozzle of the cock through a vertical arc. It consists in forming a chamber between the exit-pipe or nozzle of the cock or tap, and that part whereby the cock or tap is connected to the service-pipe or main. In this chamber a poppet-valve is situated, the head of the valve being towards the service-pipe. A coiled or other equivalent spring is employed to keep the valve on its seat when it is not desired to draw water or other liquid by means of the cock or tap; and a pin or tappet is formed on or fixed in the lower part of the valve-feather or stem, which pin passes through a hole or opening made in the bottom of the valve-chamber, and bears upon an eccentric or cam formed on the heel of the cock or tap. This eccentric or cam is so arranged that in the act of moving the exit nozzle or pipe of the cock or tap upwards or downwards, for the purpose of drawing water or other liquid, the eccentric or cam acts upon the pin or tappet, so as to force the valve back from its seat and against the resistance of the spring, and by this means the water or other liquid is allowed to flow from the service-pipe through the valve-seat, and through an orifice in the valve-chamber to the exit nozzle or pipe of the cock or tap. The valve is immediately closed by the spring and by the pressure of water or liquid behind it, and the supply of water or liquid cut off on moving the exit nozzle in the opposite direction to that before referred to, the said motion having the effect of presenting the part of lesser radius of the eccentric or cam to the pin or tappet of the valve.

Under a modification of the invention, the exit nozzle of the improved cock or tap may be a fixture in any convenient position for drawing water or liquid therefrom; and the valve-chamber may be provided with a spindle or auxiliary, having a handle at its outer end and an eccentric or cam at its inner end, which, on the spindle being turned, acts on the pin or tappet of the valve in the manner hereinbefore described.

4323.—Pieper, C., Dresden. "*Improvements in the apparatuses for the purification of coal gas.*" A communication. Patent dated Nov. 19, 1877.

This invention relates to improvements in the arrangement of the scrubber and the purifier, as used in gas-works for the purification of coal gas, and the object of the same is to construct these apparatuses in such a manner that the solid material which they contain may be extracted, and fresh material introduced, without interruption of the scrubbing or the purifying process, and without loss of gas, so that no change of apparatus is required during the regular continuation of the working.

[The apparatus is not described apart from the drawings.]

4332.—Forbes, J., and Abbott, J., Old Ford, London. "*Improvements in apparatus used in the distillation of coal for the production of coke, tar, and ammoniacal liquor, and the utilization of the resulting gases.*" Patent dated Nov. 19, 1877.

The objects of this invention are to extract from the coal the maximum quantity of tar and ammoniacal liquor, and to produce more economically a better quality of coke than when coal is distilled in the ordinary way, the resulting gas arising during this process being utilized for heating the retorts or ovens which form the subject of the present invention.

The retorts or ovens, which are made of fire-brick, are of a semicircular or D-shaped form, about 3 feet in breadth, about 12 or 15 inches high, and about 10 feet long. (These dimensions may be varied to suit particular circumstances.) They may be set single in brickwork, or a number of them may be set in a bench or row. Beneath each retort are fixed horizontally, parallel to the bottom of the retort, and about 6 inches therefrom, slabs of fire-clay. Between these slabs and the bottom of the retort are fixed two, three, or more partitions, made also of fire-brick. The partitions extend nearly the whole length of the retort, and divide the space beneath it into so many longitudinal chambers or continuous flues, each partition having an opening at one end, so as to admit of communication with the adjoining chambers. Beneath the slabs just spoken of another set of slabs are placed, also about six inches below the upper ones. The space between these slabs is divided in exactly the same manner as before described, with the exception that in this case the chambers or continuous flues are transverse, or at right angles to those immediately above them.

The retorts or ovens are furnished with mouthpieces and lids at one or both ends, similar to those employed for the production of gas, and there is attached either to one or both mouthpieces of each retort an ascension-pipe leading to a hydraulic main. In connection with the main there is an exhauster, for drawing off the gas from the retorts, and forcing it through a condenser to extract the tar and ammoniacal liquor, and through a washer or scrubber to arrest the remaining ammonia. The gas is then passed on to a gasholder without further purification.

4346.—Stephan, J. A., of Worcester, "*Improvements in the manufacture of carburetted hydrogen and oxyhydrogen gases.*" Patent dated Nov. 20, 1877.

This invention relates to the manufacture of carburetted hydrogen gas from water or from sewage, and also to the manufacture of oxyhydrogen gas, partly from the resultants of certain portions of the process employed in the manufacture of the carburetted hydrogen gas.

[The process has already been fully described in the Journal, Vol. xxxi., p. 839.]

4370.—Cornelius, G. F., Merton Abbey, Surrey, "*Improvements in the treatment of hydrocarbon oils for the manufacture of gas, and of oil for lubricating and other purposes.*" Provisional protection only obtained. Dated Nov. 21, 1877.

This invention consists in improvements in the treatment of hydrocarbon oils for the manufacture therefrom of gas and oil, by which the patentee is enabled to use waste "spirit," such as Canadian, for example.

According to this invention, petroleum spirit is taken, and there is added thereto 2 per cent., more or less, of nitric acid, and 20 per cent., more or less, of resin (which may be in powder). This mixture is then put into a suitable vessel, into which steam is injected, when the light oil or spirit will distil over; and in order to form the gas, a solid chemical, soluble in the light oil or spirit, is added, such as naphthaline, para-naphthaline, or camphine, to the extent of about 5 per cent., more or less. About 5 per cent. of camphor is then added, to purify or sweeten the gas; cotton, wool, or other porous material, is then saturated with the light oil, and placed in a suitable closed vessel, and upon air being forced through the vessel, a highly illuminating or heating gas is formed. In order to make the gas travel at a convenient distance from the gasholder, a charcoal or other fire is placed round the pipe that conveys the gas from the holder, so as to superheat the compound gas formed.

Gas manufactured as above described may be used either in combination with other gases or separately. The residue resulting from such gas manufacture is valuable as a lubricating oil, or it may be treated so as to render it valuable for other purposes where a superior oil is required.

4398.—Schülke, J., Berlin, "*Improvements in dry gas-meters.*" Patent dated Nov. 22, 1877.

This invention relates to that construction of dry gas-meters wherein the gas is caused alternately to distend one of two flexible bags, the other bag being at the same time collapsed, so as to deliver the gas with which it was previously filled.

The improvements relate principally to—

1. An improved impermeable durable material for forming the flexible bags and other parts of the meter.

2. An improved form of and appliances to the bags, whereby they are prevented from being altered in shape.

3. The arrangement of the valves and gear in such manner that only a slight force is required to reverse their position, and that such reversal takes place suddenly at the end of each distension of one of the bags.

4. The use of flexible diaphragms instead of stuffing-boxes, for ensuring the passage of rods or spindles gas-tight, through partitions separating the compartments of the meter.

Surrounding the bags and inlet and outlet valves is a chamber into which the gas is delivered before issuing from the meter, in order to act in a similar manner to the air-vessel of a pump for providing a constant flow, and also to surround the bags and valves with gas at nearly the same pressure as that contained therein, so that any variation in such pressure shall not perceptibly alter the capacity of the bags, and that the valves shall be almost in a state of equilibrium.

The flexible bags employed are those of bellows form, with alternate ridge and furrow folds. They may be either of wedge shape, the two outer sides being joined together at one end, while the other ends are made alternately to approach to and recede from each other; or the sides may be rigidly fixed, either at an angle or parallel to each other, the distension and collapsing being effected by the movement of the partition between the two bags. This partition is by preference constructed of a

flexible diaphragm fixed on a rigid framing, so that when the gas is admitted on the one side, it bulges out the diaphragm, and so increases the capacity of the bag.

For preventing the deformation of the bag by variations of pressure, the sides of the folds are rendered more or less rigid by cementing thereto pieces of any suitable rigid material, and also by providing internal ties passing across from the one side of a fold to the other. Furthermore, the folds are constructed so that where there is a ridge at top there are furrows at the sides, and *vice versâ*. Instead of employing two bags, the inventor in some cases dispenses with one of them by placing the one bag in a closed compartment of the meter, which itself forms the second measuring compartment, the gas being made alternately to pass into the bag, by the distension of which the capacity of the compartment is correspondingly reduced, and into the compartment, whereby the bag becomes collapsed.

For the material of which the bags are constructed, linen, cotton, or other suitable fabric is employed, treated with a compound formed as follows:—500 parts of gelatine are boiled with 750 parts of glycerine and 1500 parts of water, and to this are added 40 parts of chromate of potash and four parts of an alcoholic solution of salicylic acid or other suitable antiseptic substance. This compound is kept from the light until required for use, when it is applied to the fabric, which is then exposed to the light, whereby the gelatine becomes converted to a perfectly insoluble compound with the other substances, withstanding perfectly the action of all such substances as the sulphuretted hydrogen and other compounds of the gas, glycerine, alcohol, ammonia, and creosote. The fabric, prepared as above described, is applicable to the bags of all gas-meters, as also to the diaphragms and valves employed therein.

The valves and gear for admitting and discharging the gas to and from the measuring-bags are constructed as follows:—The valves, which are of disc form, and by preference constructed of a number of layers of the before described fabric, are situated in pipes leading from the inlet to each compartment of the measuring bag or bags, they being arranged by a small motion to seat alternately upon opposite seats in the pipe, so that as the one valve closes the inlet for the gas to the one bag, and opens the outlet thereto, the other valve opens the inlet to the other bag, and closes the outlet thereto.

The instantaneous reversal of the valves at the end of each stroke of the bags, so as to cause the collapsed bag to be filled, and the distended one to be emptied, is effected by tappets on the moveable part of the bags, actuating either levers or catches, so arranged as to bring into action springs that operate the valves, these springs being so arranged that when moved beyond a certain point they impart a sudden impulse to the valves, and that in either extreme position they tend to hold the valves in the position in which they are thrown.

APPLICATIONS FOR LETTERS PATENT.

1538.—Joy, A. A., Chancery Lane, London, "Improvements in apparatus for regulating the flow of gas or other fluids." April 19, 1879.

1560.—Clark, A. M., Chancery Lane, London, "An improved process for increasing the combustibility of coal, coke, and other fuel." A communication. April 19, 1879.

1622.—Thompson, R. C., Herne Hill, Surrey, "Improvements in the means employed for producing the electric light." April 24, 1879.

PATENTS WHICH HAVE PASSED THE GREAT SEAL.

4295.—Beauregard, F. A. T. de, Paris, "Improvements in the mode of utilizing the heat and the expansion of steam and gas upon the liquids, and the apparatus for effecting the same." Oct. 25, 1878.

4333.—Orme, D., Oldham, Lancs, "Improvements in wet gas-meters." Oct. 28, 1878.

4347.—Wilson, J. S., West Sunderland, Durham, "Improvements in and appertaining to apparatus for producing electric light." Oct. 29, 1878.

4352.—Cutler, S., Millwall, London, "Improvements in gas-valves, and in the arrangement of the pipes connecting them with the vessels with which they may be employed." Oct. 29, 1878.

PATENT WHICH HAS BECOME VOID

BY REASON OF THE NON-PAYMENT OF THE ADDITIONAL STAMP DUTY OF £50 BEFORE THE EXPIRATION OF THE THIRD YEAR.

1618.—Macneill, Sir J., "Improvements in apparatus for measuring and registering the flow and supply of water to consumers, or for other purposes." April 18, 1876.

PATENTS WHICH HAVE BECOME VOID

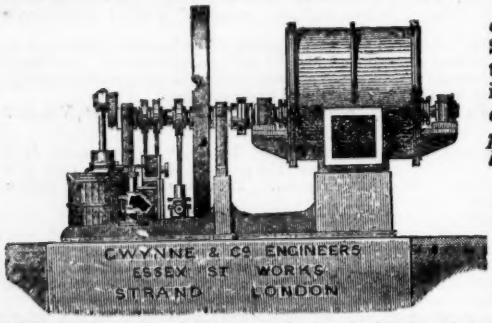
BY REASON OF THE NON-PAYMENT OF THE ADDITIONAL STAMP DUTY OF £100 BEFORE THE EXPIRATION OF THE SEVENTH YEAR.

742.—Denton, J. B., and Field, R., "Improvements in the method of regulating intermittent filtration of sewage and irrigation, and in apparatus for that purpose." March 11, 1872.

768.—Smith, T. J., "Improvements in apparatus for the production of gases for heating and other purposes." March 14, 1872.

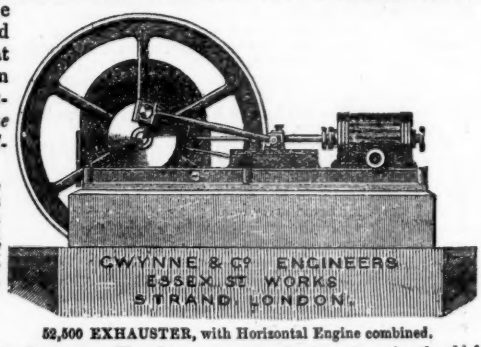
The GRAND MEDAL of MERIT at the VIENNA EXHIBITION, TWO MEDALS at the PHILADELPHIA EXHIBITION and TWO MEDALS at the PARIS EXHIBITION, have been AWARDED to GWYNNE & CO. for GAS-EXHAUSTERS, ENGINES, and PUMPS; Also 27 OTHER MEDALS AWARDED at all the GREAT INTERNATIONAL EXHIBITIONS.

GWYNNE & BEALE'S PATENT GAS-EXHAUSTERS & ENGINES.



The Judges report on the combined Exhauster and Steam-Engine exhibited at the Philadelphia Exhibition is—"*Reliable compact Machine, well adapted for the purpose intended, of excellent workmanship.*"

GWYNNE & CO. have made the largest and most perfect Gas-Exhausting Machinery in the world, and have completed Exhausters to the extent of 8,000,000 cubic feet passed per hour, of all sizes from 2000 to 210,000 cubic feet per hour.



EXHAUSTER with Trunk Engine, capable of passing 210,000 cubic feet per hour.

52,500 EXHAUSTER, with Horizontal Engine combined.

GWYNNE & CO. do not pretend to enter into a struggle with other makers in respect to cheapness. They have never sought to make price the chief consideration, *but to produce machinery of the very highest quality, and most approved design and workmanship.* The result is that in every instance their work is giving the fullest satisfaction. Numerous testimonials and references can be given to Companies using their Machinery for years past.

Exhausters, with or without Engines combined, can be made to pass the gas WITHOUT OSCILLATION OR VARIATION IN PRESSURE Regulators, Bye-Passes, Stop-Valves, Gas-Valves, Station Governors, and Gas Machinery of all Sizes.

PLEASE ADDRESS IN FULL, GWYNNE & CO., Hydraulic and Gas Engineers,
ESSEX STREET WORKS, VICTORIA EMBANKMENT, LONDON, W.C., ENGLAND.

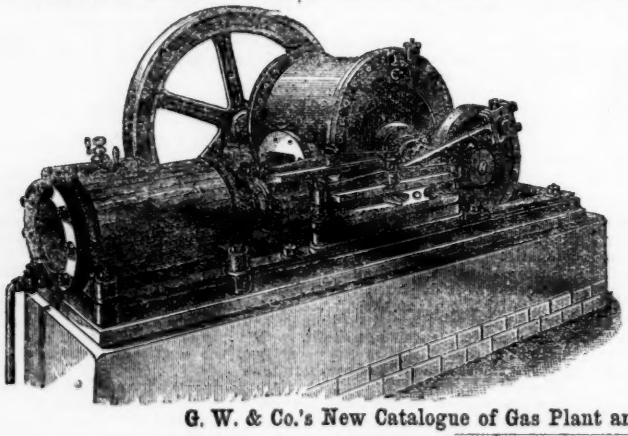
Gwynne & Co.'s New Catalogue on Gas-Exhausting and other Machinery may be obtained on application at the above Address.

BEALE'S IMPROVED PATENT GAS EXHAUSTERS

WITH

Wrought-Iron Spindles and

ENGINES COMBINED.



SOLE MAKERS,

GEORGE WALLER & CO.

MAKERS OF ENGINES, EXHAUSTERS,
INDEX AND DISC GAS-VALVES,
HYDRAULIC MAIN VALVES,
BYE-PASS VALVES,
TAR, LIQUOR, AND OTHER PUMPS,
SCRUBBERS AND PURIFIERS,
CONDENSERS, BOILERS, &c.

G. W. & Co.'s New Catalogue of Gas Plant and Machinery can be had on application.

Phœnix Engineering Works:
HOLLAND STREET, SOUTHWARK, S.E.

WANTED, Readers of the NEW Edition, 1879, "Cooking & Heating by Gas;" on Burners, &c. Copies, by post, Threepence, direct from the Author, MAGNUS OHREN, A.I.C.E., Gas-Works, SYDENHAM, S.E.

TO STOKERS.

WANTED immediately, at the Bognor Gas-Works, two Sober Men as Stokers. Must be willing to make themselves useful.
Apply, with testimonials, to W. HAMMOND, Manager.

WANTED, good Practical Working FOREMAN for the Tar Yard. Understanding Benzole, Rectifying, Washing, Anthracene, &c.
Address No. 547, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, an experienced Fitter, who understands Indoor Fitting, also Main and Service Laying. Wages 30s. per week.
Apply by letter, with references, to the MANAGER, Water and Gas-Works, WINCHESTER.

WANTED, an Appointment as Manager or ASSISTANT MANAGER of a Gas-Works. Thoroughly acquainted with the Engineering in connection with the Manufacture and Distribution of Gas upon the most approved principles.
Address G. L., care of J. Crisp, 7, Bermondsey Square, LONDON, S.E.

WANTED, a Situation as Manager or FOREMAN of Gas-Works. Dilapidated works preferred, that want Remodelling and Re-erecting. Thoroughly competent in the whole details of working, both indoor and out, in all branches. Accustomed to large works. Salary moderate, or by results of working same.
Address ROBERT CROSS, Douglas Road, Parkwood Springs, SHEFFIELD.

BOROUGH OF MIDDLESBROUGH.

WANTED, a Gas-Works Manager, to enter upon his duties early in May. The person appointed will be required to devote the whole of his time to the duties of his office. Three months notice, to terminate the engagement, to be given or taken.
Applicants must state salary expected.
Applications to be sent to the undersigned on or before Monday, the 5th of May next.
By order,
GEO. BAINBRIDGE, Town Clerk.
April 23, 1879.

TO INVENTORS.

A Merchant, who is now introducing with great success a Speciality among Gas Engineers, &c., is desirous to act as Sole LICENSEE for one or more Patents of Machinery, &c., suitable for Gas-Works use.
Address No. 546, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

TRAVELLER wanted, for London and South District, to represent an old-established Gas-Meter Manufacturing firm.
Address No. 542, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

THE undersigned, now Assistant Manager of the Black Rock Gas-Works, Brighton, will shortly be open to a re-engagement.
Address WM. WRIGHT, Assoc. Inst. C.E., 2, Princes Terrace, Kemp Town, BRIGHTON.

TO GAS COMPANIES AND MANUFACTURING CHEMISTS.

THE Advertiser wishes an Engagement as FOREMAN for the Manufacturing of Sulphate of Ammonia in all its branches of manufacture. Thoroughly understands the Erection of Works in all its branches. Twenty years experience.
Address S. C., 63, St. Leonard Street, Bromley-by-Bow, LONDON.

EXHAUSTER FOR SALE.

FOR SALE, an Engine and Exhauster combined, to pass 7000 feet per hour, together with Boiler, 12 ft. by 4 ft., Boiler Fittings, Connections, Regulator, and Stone Bed.
For particulars, apply to W. T. TEW, Gas-Works, WARWICK.

PURIFIERS FOR SALE.

FOR SALE—The Plates forming a Set of Two Purifiers, 12 ft. by 4 ft. 6 in. by 4 ft. deep, together with wrought-iron Covers, Lifting Tackle, Wood Sieves, Hydraulic Valve and Connections. The above are all equal to new, and very handy, requiring little floor space.
For particulars apply to GRAHAM ROSS, Gas-Works STONEHAVEN, N.B.

TO BE SOLD, Cheap, Three Telescopic GASHOLDERS, two 60 ft. diameter and 20 ft. deep each lift, and one 70 ft. in diameter and 20 ft. deep. Only been in use eight years. May now be seen at work at the Effingham Street Gas-Works, Sheffield.
For price, apply to THOMAS PIGGOTT AND CO., Spring Hill, BIRMINGHAM.

MANCHESTER CORPORATION WATER-WORKS.

TO be SOLD by TENDER, a large Cast-Iron CISTERN, together with the Iron Beams, &c., connected therewith; now lying at the Gorton Upper Reservoir, four miles from Manchester.
The cistern is 51 ft. 6 in. long, 26 ft. wide, and 2 ft. deep, and equal to a capacity of about 16,684 gallons.
The cistern, &c., to be removed within 14 days from the date of the acceptance of the tender.
Tenders (which must be for 112 lbs. to the cwt.), addressed to the Chairman of the Water-Works Committee, and endorsed "Tender for Iron Cisterns," to be sent to Mr. Berrey, at these Offices, on or before Wednesday, the 30th inst.
By order,
JOSEPH HERON, Town Clerk.
Water-Works Offices, Town Hall, Manchester,
April 15, 1879.

CHEMICAL PLANT FOR SALE.

THE Entire Plant of a large Factory, consisting of Lead Chambers, Steam Boiler, Steam Pumps, Retorts, Fire-Bricks, a complete Sulphate of Ammonia Plant, &c.
For full particulars, apply to R. W. WALLACE AND CO., 60, Mark Lane, LONDON, E.C.

THE Prescot Gas Company have for Sale, and which will be sold cheap, a quantity of GAS PLANT suitable for a small Gas-Works, consisting of Hydraulic Main, Mouthpieces, Ascension-Pipes, 6-in. Condensers and Washer.
Further information may be obtained from WILLIAM PRESCOTT, Manager, Gas-Works, Prescot, LANCASHIRE.

THE Yeadon and Guisely Gas Company are prepared to receive TENDERS for the TELESCOPING of a GASHOLDER 80 ft. in diameter.
Drawings and specifications may be had on payment of 10s. to Mr. E. Lister, Manager.
Tenders will be considered on Wednesday, the 7th of May.
The Directors do not bind themselves to accept the lowest or any offer.
Yeadon, Yorks, April 26, 1879.

BOROUGH OF BIRMINGHAM.

THE Gas Committee of the Town Council invite TENDERS for the Purchase of the surplus TAR to be produced and manufactured at their works at Adderley Street and Windsor Street, Birmingham, and at West Bromwich, for a period of One year, from July 1, 1879.
Tenders may be made for the supply from one or more of the works.
Further information and forms of tender may be obtained on application to me,
EDWIN SMITH, Secretary.
Offices of the Department, Old Square, Birmingham.

THE Farnham Gas Company, Limited, Farnham, Surrey, have for disposal an Hydraulic CENTRE-VALVE for three Purifiers, in good working order.
Particulars may be obtained of H. WELLS, Secretary.

SULPHATE OF AMMONIA APPARATUS.

I am now prepared to Erect Plant or Supply Plans of this New and Efficient System for Making Sulphate of Ammonia. For terms, &c., address as below. I have constructed a small apparatus (glass) which shows the principle and illustrates the working of the larger plant admirably. I guarantee this apparatus to give a first-class result in sulphate if worked according to my instructions, &c. Price of small apparatus, c.o.d., £1 1s.
Address JOHN G. HARVEY, 31, Old Georges Street, CORK.

TO MAIN LAYERS.

THE Sevenoaks Gas Company invite TENDERS for Laying a quantity of 12-in., 10-in., and 6-in. MAINS; also for Taking up and Re-laying other Mains and Services.
Lithographed specification, and conditions of the work required to be done, may be obtained (price 2s. 6d.) at the Office of the Company's Engineer, Mr. Alfred Penny, 90, Abingdon Street, Westminster, and at the Office of the Company, Sevenoaks.
Tenders to be sent addressed to EDWYN CRONE, Esq., Chairman to the Company, not later than May 7.
April 15, 1879.

THE Hampton Court Gas Company have FOR SALE, One 40 ft. by 16 ft. GASHOLDER, with six Cast Columns and Wrought Girders. To be Sold for £25, as the position is wanted.
Also the following PLANT, the whole of which is in excellent condition, having been removed for larger:—
One 8-horse Power Vertical Engine.
One 4-horse do. do.
One 15,000 feet Beale's Exhauster.
Two Beale's Slide-Valves for do.
Four Donkin's Valves.
Two Washers, with 8-in. Connections.
For further information, apply to Mr. E. PRIER, Engineer and Manager, Gas-Works, HAMPTON WICK.

TO CONTRACTORS.

THE Directors of the Tottenham and Edmonton Gaslight and Coke Company beg to invite TENDERS for the Erection at their Works, Dyson's Lane, Edmonton, of a PURIFYING-HOUSE, to be 178 ft. long and 50 ft. wide, with Two Floors and a Composite Roof.
Drawings and specification can be seen by applying to the Engineer, Mr. W. H. H. Broadberry, at the Office of the Company, Willoughby Lane, Tottenham.
Tenders, endorsed on cover "Tender for Purifying-House," to be sent in not later than Thursday, the 1st day of May next, addressed to the Chairman of the Company.
By order,
JAMES RANDALL, Secretary.
Willoughby Lane, Tottenham, April 17, 1879.

BOLTON CORPORATION GAS DEPARTMENT.

CONTRACTS FOR CANNEL AND COAL.

THE Gas Committee are desirous of receiving TENDERS for CANNEL and BEST SCREENED GAS COAL, for One, Two, or Three years, commencing 1st of July next, to be delivered free at the Bullfield or Craddock Lane sidings of the Lancashire and Yorkshire Railway, at Bolton; or, if carted, at the Gas Street or Lum Street Works, as may be required.
Sealed tenders, endorsed "Tender for Coal," specifying the description of Cannel or Coal, the pits at which they are to be raised, and the quantities proposed to be supplied, to be sent to the undersigned, on or before Tuesday, the 6th of May next, stating also cash terms for monthly payments.
The Committee do not bind themselves to accept the lowest or any tender, but the person or persons whose tender may be accepted will be required to execute an agreement for the due performance thereof.
By order,
R. G. HINNELL, Town Clerk.
Gas Offices, Bolton, April 26, 1879.

TO GAS ENGINEERS.

D. BRUCE PEEBLES & CO.

Beg to call the attention of Gas Engineers to the fact that the novel and original feature in connection with PEEBLES' SYSTEM OF CONTROLLING THE ACTION OF GAS GOVERNORS is the loading or acting on the Bell by Pneumatic Pressure instead of Weights.

TAY WORKS, BONNINGTON, EDINBURGH.

FOR PUBLIC LIGHTING.

THE PATENT COMPENSATING

STREET-LAMP METERS,

Fitted up in Water-tight Cast-Iron Boxes with footway frame, for fixing level with Pavement. Require watering only once or twice a year. Frictionless in working, and most accurate in registration.

GREAT REDUCTION IN PRICES, COMPLETE:

To pass 12 feet per hour . . . . . £3 5s. To pass 18 feet per hour . . . . . £4 10s.

Prices for the Larger Sizes on application.

IMPERIAL METER-WORKS, KING'S ROAD, ST. PANCRAS.

FORMBY GAS COMPANY, LIMITED.

CONTRACT No. 3.

THE Directors of the Formby Gas Company, Limited, are prepared to receive TENDERS for the Supply and Delivery at Formby Station (Lancashire and Yorkshire Railway, Liverpool and Southport branch) of about 6000 lineal Yards of Cast-Iron GAS-MAINS, with Socket and Spigot Joints, and special pipes in connection therewith.

Copy of specification, schedule, and form of tender, and all information, may be obtained (on payment of two guineas, which will be returned on receipt of a *bonâ fide* tender) on application to the Engineers to the Company, Messrs. Goodison, Atkinson, and Forde, Orange Court, 35a, Castle Street, Liverpool.

Sealed and endorsed tenders to be sent to me before noon of the 6th of May.

The Company do not bind themselves to accept the lowest or any tender.

FREDERICK GITTINS, Secretary.

30, Castle Street, Liverpool.

TO GAS ENGINEERS, BUILDERS, AND OTHERS.

THE Directors of the Burgess Hill and St. John's Common Gas Company, Limited, are prepared to receive TENDERS for Constructing a GAS-HOLDER-TANK. Also for Making and Fixing a Single GASHOLDER, 40 ft. in diameter.

The drawings, specifications, and conditions of contract may be seen at the Company's Office, London Road, Burgess Hill, Sussex, on application to the Secretary, between the hours of 10 a.m. and 4 p.m. on any day except Sunday.

Tenders to be delivered at the Company's Office on or before Friday, the 9th of May next, endorsed respectively, "Tender for Gasholder-Tank," and "Tender for Gasholder."

The Directors will not bind themselves to accept the lowest or any tender.

By order of the Board,
S. NORMAN, Secretary.

Gas Company's Office, London Road,
St. John's, April 12, 1879.

TENDERS FOR COALS.
SPECIFICATION.

THE Derby Gaslight and Coke Company are prepared to receive TENDERS for the Supply of 28,000 Tons of SOFT COALS and SOFT COBBLES or NUTS, to be divided into Four Contracts of 7000 Tons each, and to be delivered in the following monthly quantities, viz.:—

	Tons.
1879—May	320
June	320
July	400
August	580
September	700
October	780
November	820
December	820
1880—January	720
February	580
March	580
April	380
Total of each Contract	7000

The Company will undertake to receive from the party or parties contracting the total quantity of 28,000 Tons, in one, two, three, or four contracts, as the Board may decide; but they do not bind themselves to accept the lowest or other tender or tenders, until after a satisfactory trial of the Coals and Cobbles or Nuts to which such tender or tenders may relate shall have been made. They are to be the best of their kind, and as free as possible from sulphur, bats, bind, refuse, dirt, and shall be weighed upon a correctly adjusted machine.

Payments will be made monthly, if, and so long as, the Contracts shall be duly fulfilled, to the extent of nine-tenths of the amount of the invoices, and the balance will be discharged on the satisfactory completion of the Contract.

Sealed tenders (to be made on forms obtainable at the Company's Offices), specifying the description of Coals and the Pits at which they are to be raised, and stating the prices for delivery by canal at Derby, at the New Gas-Works adjoining the Midland Railway Company's premises, or at the Canal Wharf, and also the price delivered at either of the Midland Railway Stations, or at the Great Northern Station, Derby, and in manner and subject to the conditions aforesaid, must be delivered at the Offices of the Company, Friar Gate, on or before Saturday, the 3rd day of May proximo.

The respective contracting parties will be required to execute an agreement to be prepared by, and to the satisfaction of the Secretary of the Company.

By order of the Directors,
ISAAC FISHER, Secretary.

Derby Gas Office, April 21, 1879.

BELGIAN CLAY RETORTS.

J. SUGG and CO., late ALBERT KELLER, GHENT.—The removal of the import duties on Earthenware permitting the entry of Clay Retorts into England, Messrs. Sugg, of Ghent, beg to draw the attention of the Gas Companies of London, and other Cities, to the very superior quality of the RETORTS manufactured by them. They can be made of any size, in one piece, and of any form. The price will be in proportion to the weight, and very moderate in comparison to their value.

Communications addressed to J. SUGG & Co., GHENT, will receive immediate attention.

Price 28s., handsomely bound in Morocco, cloth sides, gilt edged and lettered.

THE FIRST VOLUME
OF
KING'S TREATISE

On the Science and Practice of the Manufacture and Distribution of

COAL GAS.

Edited by THOS. NEWBIGGING, C.E., M.Inst.C.E., and W. T. FEWTRELL, F.C.S.

Orders received by
WALTER KING, 11, Bolt Court, Fleet Street, London, E.C.

Crown 8vo., cloth, Illustrated.

ELECTRIC LIGHTING and its PRACTICAL APPLICATION. With results from existing Examples. By J. N. SHOOLBRED, B.A., M. Inst. C.E. London: HARDWICKE AND BOGUE, 192, PICCADILLY, W.

GRAND JUNCTION WATER-WORKS COMPANY.

CONTRACT FOR THE SUPPLY OF COALS.

THE Court of Directors of the Grand Junction Water-Works Company are prepared to receive TENDERS for the Supply of COALS to their Pumping Stations during the period of Twelve months, from the 1st of June next.

Forms of tender may be obtained at the Company's Offices, 65 South Molton Street, W., between Ten and Four, and on Saturday between Ten and Two.

Tenders must be delivered at the above Office, sealed and addressed to the Court of Directors of the Grand Junction Water-Works Company, not later than Ten o'clock a.m. on Wednesday, the 7th of May next.

By order,
E. O. COE, Secretary.

THE Middleton and Tonge Improvement Commissioners are prepared to receive TENDERS for the Erection and Completion of a Telescopic GAS-HOLDER, 80 ft. in diameter, with two 20-ft. Lifts, and a wrought-iron Tank for same.

Full particulars may be obtained, and plans and specifications may be seen, on application to Mr. Hartley, Gas Manager, Gas-Works, Middleton.

Tenders, addressed to the Chairman of the Gas Committee, endorsed "Tender for Gasholder and Tank," to be delivered at my Office on or before the 17th of May.

The Commissioners do not bind themselves to accept the lowest or any tender.

FREDERICK ENTWISTLE, Clerk to the Commissioners.
Commissioners Rooms, Middleton, near
Manchester, April 22, 1879.

TO CONTRACTORS.

THE Directors of the Tottenham and Edmonton Gaslight and Coke Company beg to invite TENDERS for the Construction at their Works, Dyson's Lane, Edmonton, of Six PURIFIERS, each to be 36 ft. long, 18 ft. wide and 6 ft. 6 in. deep, and to have 16 in. Connections, wrought-iron Covers, and Lifting Apparatus.

Drawings and specification can be seen by applying to the Engineer, Mr. W. H. H. Broadberry, at the Office of the Company, Willoughby Lane, Tottenham.

Tenders, endorsed on cover "Tender for Purifiers," to be sent in not later than Thursday, the 1st day of May next, addressed to the Chairman of the Company.

By order,
JAMES RANDALL, Secretary.

Willoughby Lane, Tottenham, April 17, 1879.

GAS MANAGER AND CLERK OF WORKS.

THE Directors of the Formby Gas Company, Limited, require the Services of a competent Practical Man to act as CLERK of WORKS for their Works now being erected, and afterwards as MANAGER. A house for Manager is in course of erection.

Present population about 2000.

Any further information can be obtained from the Engineers, Messrs. Goodison, Atkinson, and Forde, Orange Court, 35a, Castle Street, Liverpool, or from me.

Applications must be sent to me, on or before noon of the 6th day of May, stating age, present and past employment, and amount of salary required.

FREDERICK GITTINS, Secretary.

30, Castle Street, Liverpool.

CORPORATION OF NOTTINGHAM—GAS DEPARTMENT.

THE Gas Committee of the Corporation are prepared to receive TENDERS from Competent Contractors for the Erection and Completion of a new Retort-House, Chimney, Coal Sheds, Purifying and Meter House, Liquor Tanks, and other Works, at the Radford Gas-Works, Nottingham.

Plans and specifications may be seen on and after Monday, the 28th inst., at these Offices, when also quantities and forms of tender may be obtained on payment of five guineas, which sum will be returned on receipt of a *bonâ fide* tender.

Sealed tenders to be delivered to the Town Clerk on or before Wednesday, the 7th of May next.

No allowance for estimates, and the lowest or any tender will not necessarily be accepted.

By order,
M. OGLE TARBOTTON, Engineer.

Gas Offices, George Street, Nottingham.

CLOTH GAS-BAGS FOR MAINS,

As supplied to the Imperial, Chartered, and other London and Provincial Gas Companies. Bellows and Valves for inflating Well Dresses, Stokers Gloves, India-Rubber Suction and Delivery Hose, Gas-Tubing, Leather, India-Rubber, and Gutta-Percha Machine-Bands, Sheet and Washers, and Steam Joints.

T. BUGDEN, Manufacturer,
107, GOSWELL ROAD, LONDON, E.C.

PATENT
MACHINE-MADE RETORTS.

B. GIBBONS, JUN.,
STOURBRIDGE.

PRICE'S PATENT
LABOUR-SAVING SCREEN OR SIFTER.

In screening breeze, the coarse material falls on a tray supported by the handles of the Machine, thus making it convenient for picking the clinkers from the same, whilst the fine falls on a shoot behind, which is fixed to the bottom of the sieve B. In screening gravel or other material, the coarse will fall into a barrow direct, and the fine be conveyed by the shoot into a barrow at the other end, or at the bottom.

To practical men the advantages of this Machine will be evident. It secures at once a saving of time, labour, and expense, as by it a much greater quantity of material can be sifted in the same space of time.

Further particulars as to price, &c., may be obtained by applying to the Patentee (Hampton Wick), or to

ROBERT DEMPSTER & SONS,
(SOLE MANUFACTURERS),
ELLAND, NEAR HALIFAX.

J. BEALE'S NEW PATENT GAS EXHAUSTERS,

MANUFACTURED SOLELY BY

B. DONKIN & CO.

These Exhausters have but one solid slide, which ensures less wear and tear, and less friction, and thus fewer repairs are necessary. They are made with two outside bearings and all latest improvements.

MESSRS. B. D. & Co. ALSO MAKE

STEAM-ENGINES FOR DRIVING GAS EXHAUSTERS,
VALVES FOR GAS, WATER,
STEAM, HYDRAULIC MAIN, TAR, AMMONIACAL LIQUOR, &c.

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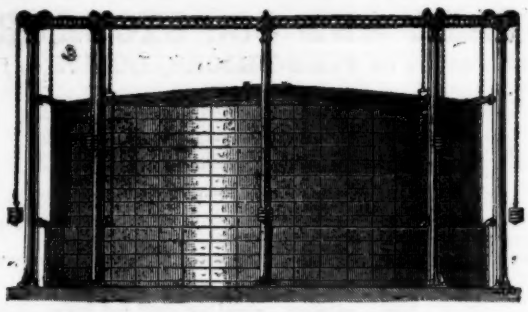

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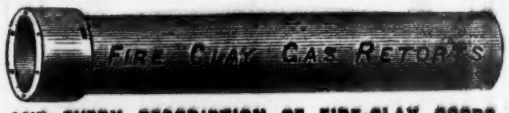

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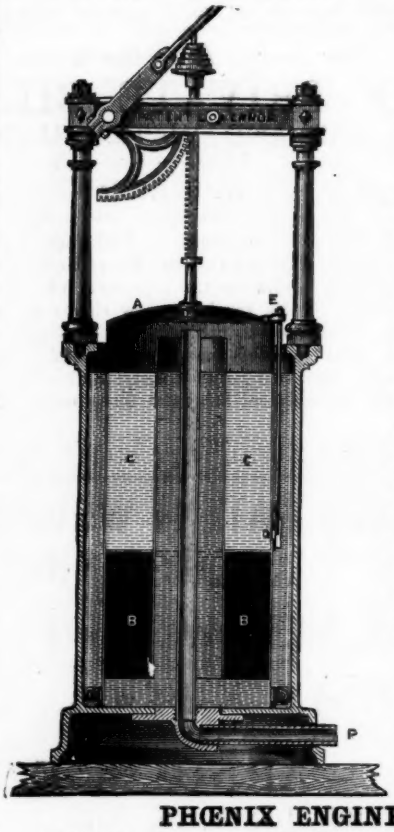
Patent Compensating Steam Governor,

WITH SELF-CONTAINED WATER-BALANCE.



DESCRIPTION OF THE APPARATUS.

The illustration represents a section of the Patent Governor. The lower part of the Bell A is fitted with a loose Float B, and in the upper part of the Bell is a deep annular Water Chamber C, at the bottom of which is an opening D, with a slide outside regulated by a Screw Spindle E, to allow the water to pass in and out of the Chamber C quickly or slowly, according to circumstances, but when once adjusted the slide does **not require altering.** This Self-compensating Chamber gives great steadiness to the up and down movement of the Bell and effectively prevents the "hunting" motion so common with other Governors, thereby ensuring a more perfect action on the throttle-valve of the Engine **than attained by any other.** The sketch shows the clip lever fixed to work on throttle-valve at an angle, and can work in either direction. P is the Gas Inlet-pipe to Governor.

G. W. & Co. also make **special Steam Throttle Valves,** suitable for working with this Governor, and alter existing Throttle Valves to same plan.

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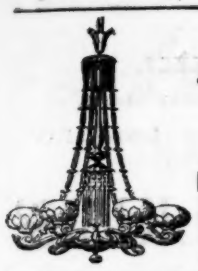

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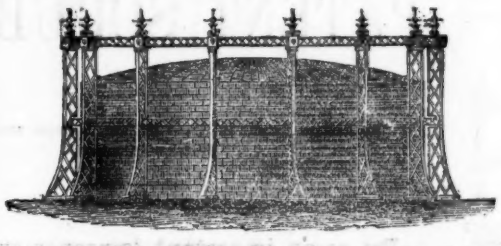

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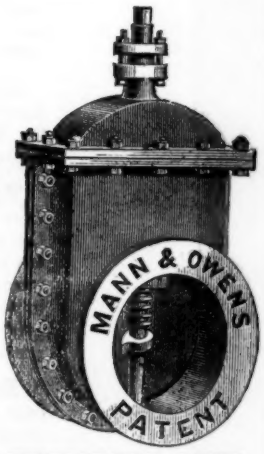

VALVE, with Indicator for Above Ground. UNDERGROUND VALVE.

The advantages of this Patent Valve over all others yet introduced are, that it is always as tight as the best wedge or spring valve, without the possibility of setting fast or becoming suddenly leaky. The surfaces not being in contact during the operation of opening or closing, leakage through wear and tear is avoided.

The Gas Engineer will not fail to see the importance of such a valve in connexion with his purifying apparatus, particularly in the case of large sizes.

The slide being operated either by a screw and nut, or by a pinion and rack, a cam bearing upon a plane, cast on the back of the Valve, forces it against the face, and renders the escape of gas an impossibility. By a slight turn of the pinion or screw, the slide is released, and brought away from the face, by which means friction is avoided, and the only force required to open the Valve is that due to its own weight.

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ESTABLISHED 1836.

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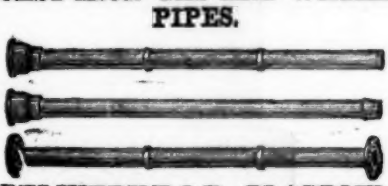

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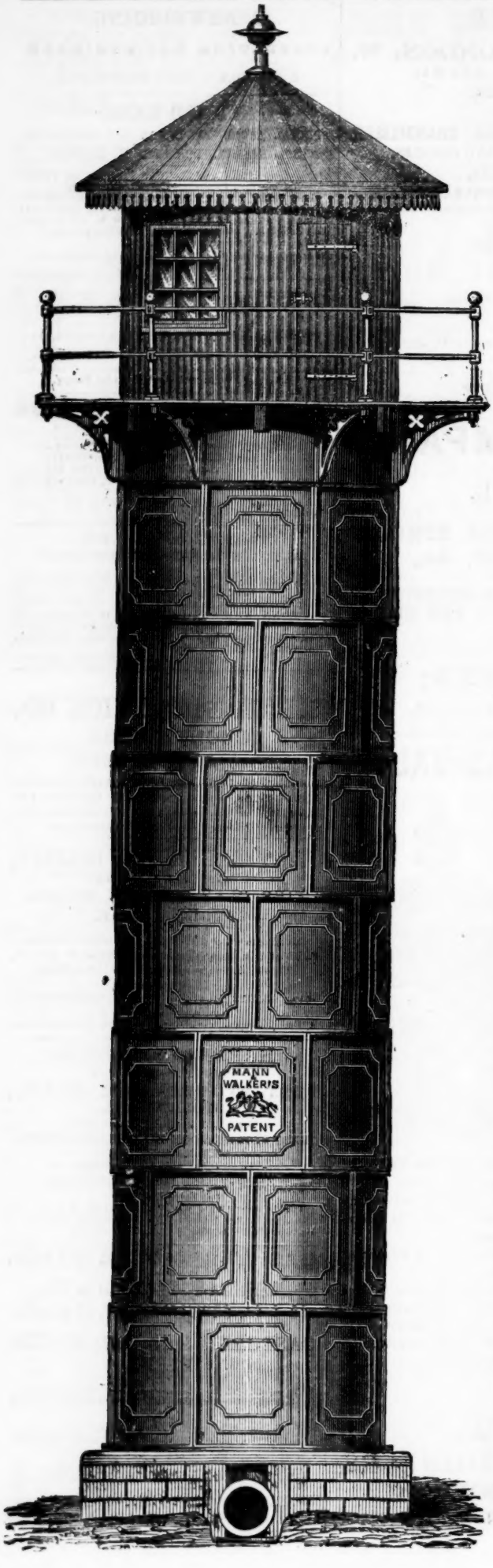

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MANN & WALKERS' PATENT SCRUBBER.

By Letters Patent in Great Britain, Europe, and the United States of America.

By some important improvements recently patented, the purifying power of these Scrubbers has been much increased, and a stronger ammoniacal solution obtained, which is found to absorb a large portion of the carbonic acid contained in gas, effecting an important saving in money and labour in the lime purifiers, and where oxide only is used, the increase in the illuminating power of the gas obtained by these Scrubbers is shown in a remarkable degree, in consequence of the large quantity of carbonic acid removed from the gas.

It is to be particularly noted that the im- portant results of these Scrubbers do not depend upon the machinery alone. The entire internal construction of the Scrubber bears an almost equally important part. For this reason, where it is desirable to convert existing Scrubbers, whose dimensions happen to be suitable, the work commences by ripping out the whole of the interior of the shell, and beginning the internal construction *de novo* from bottom to top.

Fifty million cubic feet of gas per 24 hours are purified from ammonia by these Patent Scrubbers in a winter's day in the gas-works of London, where the purity of gas supply is the highest in the world, under the chemical restrictions of the Board of Trade.

Generally, wherever a high standard of purification is maintained in the chief cities and towns of the British Provinces and of Europe, these Scrubbers have become established.

By their use the department of purification from ammonia upon a gas-works is made complete, without the aid of prepared oxide of iron, chemicals in purifiers, or any other supplementary process, and the whole ammoniacal residual product contained in the coal is absorbed and obtained in the form most profitable to a gas company, while the requirements of all Acts of Parliament and of the Board of Trade, relating to incorporate gas companies, are satisfied.

Foul Gas, properly condensed, entering the inlet is, by once only passing through the Scrubber, completely purified from ammonia with regular certainty day by day, without any further trouble, or any other process, effected by a very small quantity of clear water let into the machinery room at the top of the Scrubber, which is discharged at the liquor outlet at the bottom, from Newcastle coal at about 18 to 20 ounces strength, from Yorkshire and other coals generally from 25 to 30 ounces strength; while acidulated litmus or turmeric exposed at the Scrubber outlet will not show the slightest discoloration, and there is not a quarter of a grain of ammonia per 100 feet left unabsorbed.

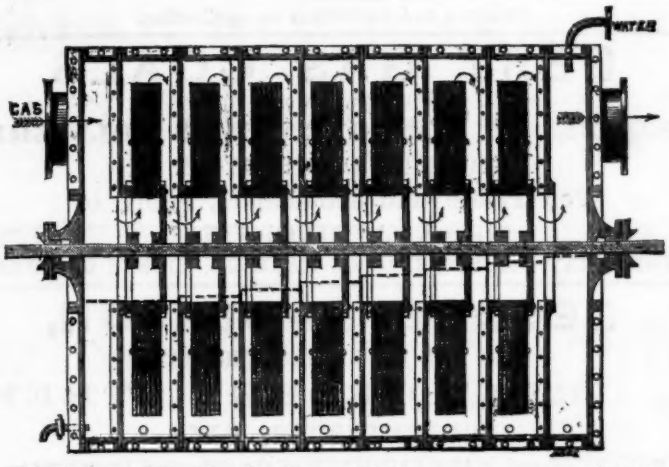
They contain their own engine power, requiring only a small inappreciable quantity of steam from the gas-works boiler, and are then complete in themselves, ready for service.

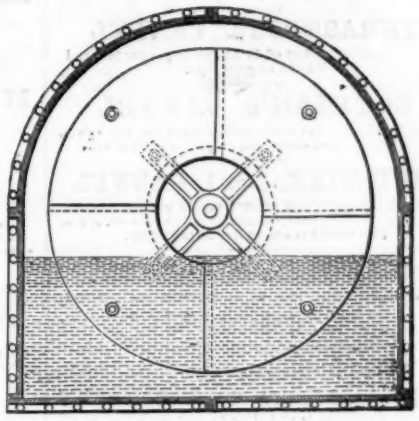
Applications relating to dimensions and prices should be addressed to us, C. AND W. WALKER, 8, FINSBURY CIRCUS, LONDON, E.C., or to Mr. WILLIAM MANN, late Superintendent of the Chartered Gas-Works, BLACKFRIARS, LONDON; they should state approximately the largest make of gas in 24 hours on a winter's day, and the smallest make on a summer's day, to be purified.

THE

"STANDARD" WASHER & SCRUBBER.

[KIRKHAM, HULETT, AND CHANDLER'S PATENT.]





This Washer and Scrubber has been used for nearly two years on a large scale at the Works of The Gaslight and Coke Company, Bromley-by-Bow, at which station there are now several in operation and in course of construction. There is also one in use at the Pancras Station, King's Cross, of the same Company, which is purifying 1,500,000 cubic feet of gas per day. At the Gas-Works of the Corporation of Leeds, a large one has been erected, which is giving complete satisfaction. The Special Merits of this Washer are as follows:—

That it is a very effective Condenser, so that it is not absolutely necessary to reduce the temperature of the gas to 60°, or thereabouts, to make the Washer effective.

That the distribution of the liquor is made with unerring regularity.

That it occupies very small space, so that it can be, at little expense, effectually protected from extreme changes of the weather.

That the considerable expense of Coke or Wood, or other Scrubbing Material, is entirely saved, and that the great nuisance and cost of from time to time replacing the Scrubbing Material is avoided.

That, by the revolution of the discs, the quantity of water carried up by them, and tending continuously to fall, exposes a very large amount of fresh wetted surface to contact with the gas.

That it is particularly adapted for Gas-Works where Sulphate of Ammonia is manufactured.

That it is much cheaper than any other Scrubber that will do the same amount of work effectually.

That it is the only Washer suitable for purifying Gas from all its impurities by solution.

That it works with a minimum of pressure.

That it takes out every trace of Ammonia from the Gas in once traversing the machine.

That it requires very little outlay for foundations.

The following Testimonials show the opinion of eminent Engineers as to the capabilities of the Washer:—

(Copy.)

The Gaslight and Coke Company
Bromley-by-Bow, May 3, 1877.

D. HULETT, Esq.

Dear Sir,—In answer to your inquiries respecting the results of the working of your Patent Washer, I beg to state that I find it a very efficient machine. I have had it in operation for some time, and passed gas through it continuously at the rate of 100,000 cubic feet per hour, and obtained from it 11 gallons of 10 oz. liquor per ton of coal carbonized—results which appear to me very satisfactory for so small a Washer. It works very smoothly, taking but little power, and giving no pressure. I have it still in operation, and am perfectly satisfied with its working.

I am, dear Sir, yours truly, (Signed) W. B. WRIGHT.

(Copy.)

The Leeds Corporation Gas-Works,
York Street, Leeds, Dec. 6, 1878.

Messrs. KIRKHAM, HULETT, and CHANDLER.

Gentlemen,—The Scrubber-Washer erected by you at these works, and which has been in use for six months, has proved to be, so far as we have been able to test it, thoroughly efficient. We are at present making 32,000 feet of gas per hour, and are entirely dependent on this apparatus for the removal of Ammonia, and the **Gas is perfectly free from that impurity in the sixth chamber**, so that four chambers remain to deal with an increasing make of gas. Owing to insufficient condensers, the gas was in the summer admitted to the Scrubber at a temperature of 70°, but was reduced therein to 61°, or that of the atmosphere. The volutes are driven at the rate of four revolutions per minute, and, working at that speed, there is not the slightest difference between the inlet and the outlet pressure. Clean water supplied at the rate of 10 gallons per ton of coal carbonized is converted into liquor of from 10 oz. to 13 oz. strength **in once traversing the vessel.** The apparatus is extremely simple and compact, occupies but little space, and requires no foundation. I shall be surprised if it does not eventually become extremely popular.

I am, Gentlemen, yours faithfully, (Signed) HENRY WOODALL, Engineer.

(Copy.)

The Gaslight and Coke Company.
York Road, King's Cross, Jan. 14, 1879.

Messrs. KIRKHAM, HULETT, and CHANDLER.

Gentlemen,—In reply to your inquiry, I am pleased to say, the Washer which was put in action at this station in October last has quite fulfilled my expectations, as it confirms the experiments I made in May last with the smaller machine. Working at four revolutions per minute, **it takes out every particle of Ammonia**, while purifying more Gas than it was intended to do. I enclose particulars of a fortnight's working during our heaviest make, by which you will see that it yields the full quantity and strength of liquor, and works with little pressure. I am therefore quite satisfied with the machine, and trust it may meet with the success it deserves.

I remain, Gentlemen, yours truly, (Signed) JOHN CLARK.

The following Table shows the results of the working of one of these Washers, lately erected to purify 60,000 feet of Gas per Hour, at the St. Pancras Station of The Gaslight and Coke Company:—

1879.	Nos. of the Divisions and Strength of Liquor in each.										Water used per Ton of Coals.	Gas Purified per Hour, Cubic Feet.	Ammonia on Outlet.	Temperature.			Pressures.		Revolutions per Minute.
	1	2	3	4	5	6	7	8	9	10				Inlet.	Outlet.	Atmosphere.	Inlet, Inches.	Outlet, Inches.	
	oz.	oz.	oz.	oz.	oz.	oz.	oz.	oz.	oz.	oz.									
January 1	8½	6¾	5	3½	2½	1½	¾	½	0	0	10 Gallons.	52,000	Nil.	77°	73°	48°	24	23	7½
,, 2	8¾	7	6	4½	3¼	2½	1½	¾	½	0	10 ,,	57,000	Nil.	73°	66°	32°	21¾	20½	4
,, 3	9¼	8	6	3¾	3	2½	1½	¾	½	0	10 ,,	60,000	Nil.	75°	68°	40°	23½	22	4
,, 4	9½	7¾	6½	4½	3½	2½	1½	¾	½	0	10 ,,	65,000	Nil.	74°	68°	33°	24	22½	5
,, 5	9½	7	6	4	3	2½	1½	1	½	0	10 ,,	34,000	Nil.	77°	68°	35°	14½	14	5
,, 6	9¼	7¼	6½	4½	3	2¼	1½	1	½	0	10 ,,	63,000	Nil.	72°	66°	27°	24	22½	4½
,, 7	11	9	7	5½	3¾	3	1¾	1¼	½	0	10 ,,	59,000	Nil.	74°	66°	31°	25	23½	5
,, 8	9½	7½	6	4½	3	2	1	¾	½	0	10 ,,	78,000	Nil.	73°	61°	31°	28	26½	4½
,, 9	11	9	7	5	3¾	2½	1½	1	½	0	10 ,,	82,000	Nil.	74°	67°	33°	27½	25½	5
,, 10	10½	8½	6¾	5	3½	2½	1½	1	½	0	10 ,,	66,000	Nil.	76°	64°	28°	28½	27	5
,, 11	12½	10	7¾	5¾	4¼	3¼	1¾	1¼	½	0	10 ,,	61,000	Nil.	73°	64°	27°	26½	25½	5
,, 12	11	8¾	6¾	—	—	—	1¼	¾	½	0	10 ,,	39,000	Nil.	74°	64°	27°	26½	25½	5
,, 13	13	10¾	8¼	6	4¾	3½	2	1½	½	0	10 ,,	78,000	Nil.	73°	65°	42°	28	26	5

(Signed) JOHN CLARK, Engineer.

For further particulars and testimonials, address

Messrs. KIRKHAM & HERSEY, GAS ENGINEERS, 21, ABINGDON STREET, WESTMINSTER.

ROBERT MARSHALL,

CANNEL COAL MERCHANT,

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SHOTT'S BOGHEAD.

HARTHILL CANNEL

Yields 14,920 cubic feet of 40·92-candle gas per ton.

THRASHBUSH CANNEL

12,530 cubic feet of 40·22-candle gas per ton, and 9 cwts. of good coke.

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Yields 13,800 cubic feet of 34-candle gas per ton, and 9 cwts. of excellent coke, containing only 4 per cent. of ash.

MUIRKIRK, No. 1, CANNEL

Yields 12,160 cubic feet of 32·5-candle gas per ton, and 10 cwts. of excellent coke, containing only 5 per cent. of ash. This cannel is almost free from sulphur.

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Yields 13,300 cubic feet of 32·5-candle gas per ton.

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THE MIRFIELD COAL COMPANY are supplying GAS COAL of the best quality on trucks at their siding. This Coal contains 10 per cent. of Cannel, and, as analyzed by Mr. James Paterson, of Warrington, yields 12,600 *cubic feet of* 16·67 *candle gas, with* 1430 *lbs. of good Coke, per ton.* Ash in Coke, 1·88.

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GAS COAL.

POPE & PEARSON, LIMITED, have now the authority of several of the most eminent Gas Engineers of London in stating that their Coal yields *in practical working over* 10,000 *cubic feet of gas, with an illuminating power of* 16 *candles;* or by the standard burners now used by the London Gas Companies, an illuminating power equal to 17½ candles.

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T. Stone, Esq., of Weymouth, writes on Nov. 17, 1876: "I have used about 12,000 tons of this Coal, with, I think, the best possible results, although not always under the most favourable circumstances. My Coal account made up to Midsummer last showed a makeage of 10,594 cubic feet per ton of 14½-candle gas, and not a hundredweight of Cannel used. This statement would, I know, be incredible to many men, and may provoke the remark, 'How much of it is paid for?' For the gratification of such, I have to say that, of the above quantity, 9866 cubic feet per ton of Coal carbonised were brought to charge and duly paid for, with the exception of about 6s. per cent. for bad debts. The coke is of excellent quality. The above facts I hold to be a greater recommendation to your Coal than any words of mine could be."

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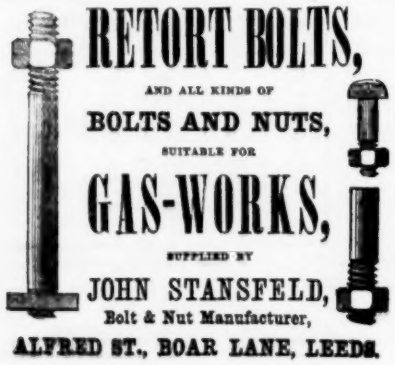

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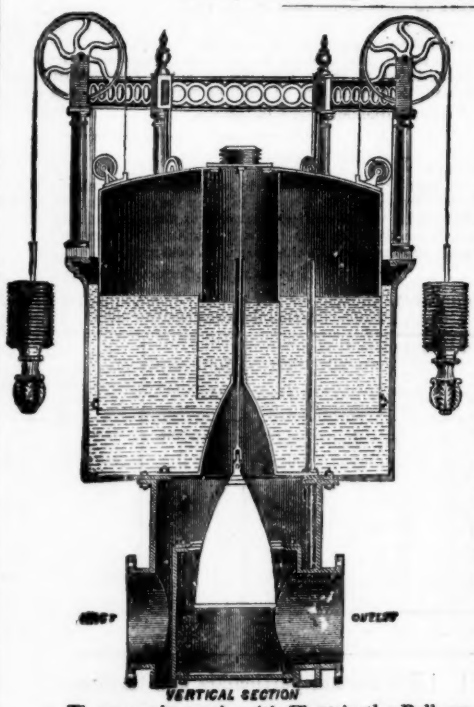
PATENT COMPENSATING GAS GOVERNOR,

Which is designed to give an uniform pressure at the Outlet to the Main at all draughts up to the full quantities which the Governors are made to control, such outlet pressure being less than the initial pressure.



VERTICAL SECTION

The uniformity of pressure is obtained by introducing a compensating chamber into the Bell or Holder of the Governor, which compensator is of the same area as the valve, both of which are operated on by the initial pressure, thereby placing the valve in equilibrium, no matter what the initial pressure may be. The action on the Bell is by the Gas passing along a pipe from the outlet, and the pressure is regulated by weights in connexion with the Bell as required.

From the sectional elevation attached hereto, it will be seen that only the Gas required to operate the Bell comes in contact with the water of the tank, which water will remain comparatively sweet and free from odour. That in case of accident to the Bell, no more Gas can escape than would pass up the pipe covering the valve-rod and Bell supply-pipe.

These Governors have been made and sent out of various sizes for from 2 to 24-inch Mains, and give most satisfactory results.

They can be made with Float in the Bell, or counterpoise as per section.

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REAL OLD SILKSTONE GAS COAL.

JAMES PATERSON Esq., Gas Engineer, of the Warrington Gas Company, reported, Aug. 10, 1875:—

"This Coal possesses remarkable qualities as a gas and coking coal, and appears SECOND TO NONE IN THE KINGDOM. It contains the large quantity of 699 lbs. of illuminating matter, and 1498 lbs. of coke to the ton, and produces **12,240** cubic feet of 16·66 candle gas."

The above Company are raising nearly a thousand tons of the Real Old Silkstone Gas Coal per working day.

PRICES QUOTED TO ANY RAILWAY STATION, OR F.O.B. HULL, GRIMSBY, GOOLE, KEADBY, LIVERPOOL, AND FLEETWOOD.

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Are Buyers of SULPHATE AMMONIA in Large or Small Quantities, or Sell on Commission for Gas Companies and Makers.

PLANT ERECTED ON THE LATEST AND MOST APPROVED PRINCIPLE.

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Being the Highest Honour given for this class.

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SPECIAL NOTICE.—Our Patent Machine-Made Retorts have now been thoroughly tested, and have proved themselves infinitely superior to those made by hand. At several large works it has been settled, beyond question, that, owing to the compactness and general excellence, more gas is sent to the gasholder from each ton of coal carbonized than is the case with hand-made Retorts.

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THORNCLIFFE IRON-WORKS AND COLLIERIES,

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CELEBRATED SILKSTONE GAS COALS.

The various descriptions of Gas Coal produced from the above Collieries possess an unequalled reputation, combining in a large degree the constituents essential for the production of the best quality of Coke and Gas of a high illuminating power.

A recent extensive development of the Collieries enables us to offer increased supplies.

JAS. PATERSON, Esq., of Warrington, after testing various qualities of our Coal, has sent the following testimony of their merits:—

"*Warrington Gaslight and Coke Company,*
Offices, Mersey Street, Warrington, April 23, 1877.

"MESSRS. NEWTON, CHAMBERS, AND CO.,

"GENTLEMEN,—After carefully testing the various samples of Gas Coals sent from your Collieries for analysis, I have pleasure in reporting them as belonging to the highest class of Gas and Coking Coals.

"The average of Nine samples gives a yield of **12,500** cubic feet of **15½**-Candle Gas, being equivalent to **664** lbs. of sperm per ton, and **1420** lbs. of fixed carbon of a very superior quality. All the samples bear a close relation to each other in value.

"Yours truly, "JAMES PATERSON."

Full particulars will be sent on application to us—address as above.

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MANUFACTURED BY THE

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The object attained by this invention is the *correct measurement of Gas under every fluctuation of the pressure.*

Accuracy is obtained by subjecting the whole of the water which determines the measuring chambers of the drum to one uniform even pressure, and so prevents unequal displacements of the water-line.

The "RELIANCE" METER has been tested by several of the most experienced official meter inspectors. Copies of their reports may be obtained on application to the

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STATION-METERS, AND GOVERNORS.

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THE UNVARYING WATER-LINE GAS-METERS,

IMPROVED DRY GAS-METERS, in Cast-Iron or Tin-Plate Cases;

STATION-METERS, ALL SIZES, up to 15 feet Square, with PLANED JOINTS;

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HYDRAULIC APPARATUS for Lifting and Lowering Purifier-Covers.

Sixteen recently erected at Beckton, applied to Covers 30 feet square.

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IN SUCCESSFUL OPERATION AT THE NEW WORKS OF THE NEWCASTLE AND GATESHEAD GAS COMPANY.

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